

NEWS IN PERSPECTIVE

ECONOMIC CLIMATE

LEVELLING OFF of the business rise, noticeable in recent weeks, is no cause for alarm. The rate of economic activity is still high. There are signs that when the economy breaks out of its current period of consolidation, it will move higher. Members of the National Association of Purchasing Agents confirm that some of the steam is out of the boom. Production is still moving up, but not as fast as it was. In the same way, new orders are rolling in to most industries at a satisfactory clip, but order backlogs are not growing as quickly as they were a few months ago.

SLOWDOWN IS HELPFUL in the eyes of many economists. It will prolong the period of prosperity and aid in avoiding the instability that could easily beset an economy forced into a pattern of unsustainable growth. Inventories have built up quickly. They now stand close to a two-year high. Sales at the manufacturers' level have not risen proportionately. New orders show a modest dip, but they are still higher than a year ago. Construction is rolling along nicely, with new records showing up on the books. Even home-building, which has been slowed by relatively high interest rates, is expected to push to a higher level later in the year.

BUSINESS INVESTMENT PLANS are a particularly bright spot in the outlook. All major industries plan to put more money into plant and equipment this year than last. In 1960, capital spending is expected to total \$37-billion, up 14 percent (\$4.5-billion) from 1959. Manufacturers of durable goods will hike outlays by 33 percent; nondurable goods makers will move up 19 percent. Electric utilities plan to jump capital expenditures by 7 percent. On a seasonally adjusted basis, investment in

the first half will run at a rate of \$36-billion or so. This argues a rate of \$38-billion in the second half, giving the economy a forward shove at an opportune time.

MANAGEMENT VIEW

DETROIT EDISON RESEARCHERS have built and tested laboratory models of fuel cells and thermoelectric generators as part of the effort of a recently appointed Advance Project Committee "to insure broad coverage of research and development which might have a bearing on the company's business." The Detroit utility noted in its annual report that this program includes a number of studies of the feasibility of converting heat and electrical energy directly into electricity, but is concerned with all phases of utility operation.

"OUR RESIDENTIAL CUSTOMERS used an average of more than 2½ times as many kwh in 1959 as they did in 1949," Tampa Electric's Wm. C. MacInnes told the N. Y. Soc. of Security Analysts recently. He added: "This use can be expected to more than double before the end of the present decade." Construction requirements for the Tampa utility by 1965 (\$150-million) will nearly double the firm's present plant investment of \$160-million, Mr. MacInnes reported.

SCHOOL AND CHURCH HEATING with electricity in western Pennsylvania are due to get a 25 percent reduction in rate beginning in May, if the Public Utility Commission okays a West Penn Power application for revision to the lowest charge (2.5-cents for each kwh after the first 1200 used monthly) the utility has had.

MEDICAL INSURANCE PLAN adopted by the Potomac Electric Co. and called the first such comprehensive program in the U. S. is cost-free to employees. The utility pays for employees, but they

NEWS IN PERSPECTIVE

pay for a spouse (\$6.84 a month) plus \$3.01 more for coverage of their children. Maximum benefits are \$15,000 for each insured, and the plan continues after employees retire.

EMPLOYEE RECREATIONAL FACILITIES, now operated by nearly 100 companies affiliated with EEI, are best controlled by employee-elected boards, the companies find. Potomac Electric Co., latest to establish such facilities, is developing a recreation center on a 519-acre area originally purchased for use in connection with a proposed generating station . . . and the employee governing body is deciding the activities to be included.

"THE HUMANS INVOLVED must offer understanding, foresight, courage, and above all cooperation" to surmount the problems involved in utilizing the waterpower resources with which the Pacific Northwest is generously endowed, B. C. Electric's Pres. A. E. Grauer observed recently. He warns: "The rivers are big and they have many and complicated problems--engineering, financial and political. The handling of these problems can only be set back by emotionalism, wishful thinking or looking at facts from the angle of pre-determined views." (Last month, the national planning associations of the U. S. and Canada urged an early start in harnessing the Columbia River--See page 46--and Canadian Foreign Affairs Minister Howard Green expressed the opinion the U. S. Congress would give quick approval to a treaty, after which development can start without delay.)

WASHINGTON INFLUENCE

ANTITRUST POLICY is getting tougher. Out-of-court settlements with firms accused of violating antitrust laws in dealing with state and local governments (through such devices as rigged or collusive bids) will be made only if accompanied by an admission of guilt. On the basis of such "consent decrees," damage suits can be started by state and local authorities. Furthermore, private treble damage suits against such firms may be facilitated by this new policy.

The indictments in two of the Justice Department's current suits against the electrical equipment manufacturers charge a collusive bidding and price-fixing conspiracy injuring municipalities, utility districts, power authorities, and cooperatives in at least 34 states. Successful state or federal criminal or civil actions--especially when preceded by thorough discovery or grand jury proceedings--could be a useful source of evidence on which to base a damages action, the Justice Dept. advises state attorneys general.

DEPRECIATION ACCOUNTING RULES, long a bone of contention, have been clarified by the Securities and Exchange commission. (See page 46.)

TAX DEPRECIATION RULES are not likely to be changed by Congress this year. The Ways and Means Committee has heard Administration requests to impose the income tax rate, rather than the capital gains rate, on any profits made in selling depreciated property. Business interests have sought quicker depreciation as an incentive for replacement of an estimated \$90-billion in obsolete plant equipment. Chances are that Congress will defer action until next year, when a wholesale overhaul of the Tax Code is anticipated.

SUBSIDIES WILL BE STUDIED by the Congressional Joint Economic Committee. An objective survey will begin this year, designed simply to identify both subsidies and "items of omission which give rise to identifiable special group benefit."

NO ENERGY SHORTAGE is immediately in sight, according to the Joint Economic Committee. But the group says that "the variety and extent of government regulation, coupled with a complex or relationships, needs considerable study." The Committee wonders whether "the government itself by its policies is not adding unnecessarily to the economic complexities and uncertainties" surrounding regulated industries.

WATER RESOURCES PLANNING and development bill introduced by Rep. Aspinall (D., Colo.) may get Administration approval. Deputy Budget Director Elmer B. Staats wrote Sen. Murray (D., Mont.)

NEWS IN PERSPECTIVE

that there is no reason to pass a proposed federal law on resources and conservation. He added: "In the area of water resources planning and development, where federal responsibility is divided among several agencies, we are inclined to believe that the principal improvement that could be made in organization at this time would be to provide statutory authority for the President to establish, as needed, regional or river basin commissions with authority to cooperate with the affected state governments."

LOBBYING EXPENSE RULES which appear to question deductibility of ECAP would be changed by Rep. Hale Boggs (D., La.). He seeks quick Congressional approval of a bill to permit deductibility of "expenses lawfully incurred in supporting or opposing or otherwise influencing legislation." The bill is endorsed by the Commerce Department. Treasury is cool to it, but says that it's up to Congress to make new rules.

1961 BUDGET has been cut by \$10-million as a result of changes in public power projects. The President told Congress that a labor dispute will make it possible to defer \$8.5-million requested for the Glen Canyon unit of the Colorado River Storage project. A request of \$1.5-million for equipment for the Bonneville Power Administration turned out to be unneeded.

AEC'S BUDGET has been defended by Chairman McCone before the JCAE. Most controversial request was for a hike to \$95.5-million (with a ceiling of \$110.5-million) in funds for the cooperative power demonstration program. This is an increase of \$10-million. Also requested was \$15-million for research support of unsolicited power reactor proposals from the utility industry.

AEC PATENT POLICY has been criticized by the National Association of Manufacturers. It made two recommendations to JCAE: (1) delete patent references from the Act except possibly those having to do with "weapons, secrecy or compensation so that in the non-weapon field there will be a uniform patent law" and (2) revise contracting procedure "to afford the contractor ownership of U. S.

and foreign patents covering inventions and discoveries arising out of or resulting from government contracts" with ownership subject to a free, non-exclusive license from the government.

A-POWER PLANTS IN ANTARCTICA have been proposed by Sen. Jackson (D., Wash.). Use of small nuclear plants now under development, he says, would obviate expensive transport of fuel, contribute to research, and add to our international prestige. Preliminary cost estimates show that McMurdo Sound Station--the largest of the three--would be "on the order of \$9-million fully installed" with Byrd and South Pole stations substantially less.

INDUSTRY SIFTINGS

COST REDUCTION PROGRAMMING achieves a "breakthrough" with a new Minneapolis-Honeywell system that "eliminates endless manual program coding by enabling the computer to translate simple statements in English into its own detailed machine instructions." Known as FACT (Fully Automatic Compiling Technique), the system "makes it possible to write and check out programs five to ten times faster than by previous manual techniques," according to Pres. W. W. Finke, of M-H's Datamatic Division.

RENT-A-COMPUTER PLAN offered by GE makes its miniaturized A-C network analyzer available (at a monthly fee of \$180) for analyzing transmission problems and calculating power system design.

YANKEE ATOMIC is well ahead of schedule, Pres. William Webster told AEC. Fueling may occur by July 1, instead of the Aug. 1 target date. Out of the \$50-million for plant and the \$7-million for nuclear core, expenses and working capital, even some savings may be possible in the project cooperatively developed by 11 New England utilities.

TVA'S RATED CAPACITY now is 11,386,710-kw.

"KNOW YOUR ELECTRIC RANGE," the popular EEI home service booklet, is now available in a new updated edition.

NEWS IN PERSPECTIVE

STEAM-GAS TURBINE UNITS may be the best way of holding down costs for small and medium size utilities that are expanding two Kaiser Engineers proposed to an ASME gas turbine and hydraulic conference held in Texas last month. "A steam-gas turbine exhaust fired cycle" can offer a "substantial cost savings plus a gain in plant efficiency" over steam-electric combinations, according to M. Eisler and W. M. Sybert.

CONEDISON SOLD \$60-MILLION worth of preferred stock last month, when eight institutional investors bought 600,000 shares in one of the biggest private transactions in public utility history.

THE ST. LAWRENCE PROJECT is the first annual award winner of the American Society of Civil Engineers--"the outstanding civil engineering achievement of the year." Four entities of the U. S.-Canadian project will receive plaques at Massena, N. Y., on May 19.

HOURLY-OF-WORK COST in the steel industry (about \$4 in '59) is about 30 percent greater than the government-compiled "wage rate for steel industry employees," U. S. Steel points out in its '59 annual report. Reason for this disparity, says U. S. Steel, is the failure of government to figure so-called "fringes"--the effects of payments for time off and for employee benefits.

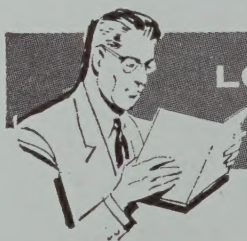
UTILITIES' ISOTOPE WORKSHOP, perhaps the first in the nation to have the coordinated sponsorship of the electric companies of the state, was held at Yale University March 30-31. To help Connecticut industry stay competitive, radioisotope uses are being promoted for their cost-saving possibilities in manufacturing. Conn. L. & P., Hartford Elect., United Illuminating and Housatonic P. S. joined the AEC. Conn. Develop. Comm. and Yale staged the workshop. Another goal: a Radioisotopes Institute for the state.

TOP SAFETY RECORDS in '59 include: Central Illinois Light Co. (honored the National Safety Council for the lowest

accident frequency rate of any U. S. utility in its class); Cleveland Elect. Illuminating Co. and Monongahela Power Co.--both with the "best accident prevention records in company history."

FIRST "TOTAL ELECTRIC" Gold Medal Home in the U. S.--one of 16 to be built in a Westinghouse program co-sponsored with utilities throughout the country--has been completed in Tampa, Fla. In the custom-designed home electricity provides year-'round climate control, illumination, entertainment, and other services and functions.

FIRST 500-MEGAWATT UNIT being built by a private U. S. utility (Commonwealth Edison) will be served by a steam generating unit to be supplied Combustion Engineering. Shipping date for the C-E boiler is July, 1961; completion date for the plant is 1963.



LOOKING AHEAD... FINANCIALLY

--From Irving Trust

First quarter totals of financing by electric utility companies with assets of over \$35-million was \$417-million, including \$324-million of debt, \$70-million of preferred, and \$23-million of common. This was somewhat less than one-quarter of the estimated total for the year.

So far about \$351.5-million has been scheduled for the second quarter: \$264.5-million of debt, \$2-million of preferred, about \$60-million of common and \$25-million of a type not yet determined. At this rate, somewhat less than one-half of the year's estimated financing will be completed by the end of the first half of 1960, leaving the possibility that scheduling may be heavier later in the year unless more issues are put into the second quarter.

The largest electric issue coming up in the second quarter is the \$40-million of Southern Electric Generating Company bonds in June.

Naughton Charges Dems Adopted "Socialist" Plan

Socialization of America's electric industry is openly advocated in the platform on energy which Western Democrats adopted in February at Albuquerque, N. M., according to E. M. Naughton, Utah Power & Light Co. president.

Mr. Naughton said that the Western Democratic Plan "has exactly the same aim as a plank adopted by the Socialist Party in 1928."

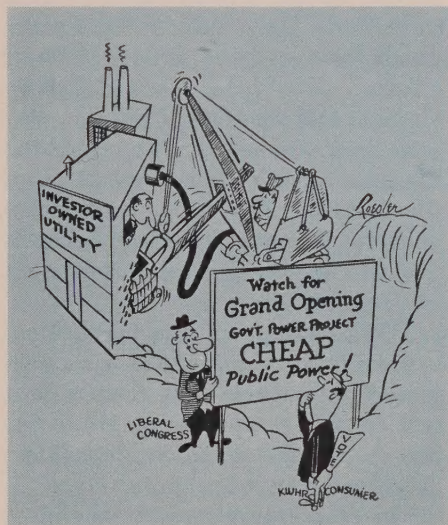
At Albuquerque, Mr. Naughton asserted, Democrats voted to "foster development of efficient regional giant power systems from all sources, hydro, thermal and nuclear, with utility responsibility to supply low-cost electricity at wholesale to all retail electric systems—public, private and cooperative."

The 1928 Socialist plan, he said, advocated nationalization of our natural resources and establishment of "a publicly-owned power system under which the Federal government shall cooperate with the States and municipalities in the distribution of electric energy at cost."

Mr. Naughton said the Socialists finally abandoned this open advocacy of nationalizing the electric industry and decided to accomplish their aims indirectly through infiltration of their ideas and concepts into other political parties and government agencies."

Mr. Naughton said members of the Socialist party did infiltrate into government and held responsible positions, thus helping shape a course which has increased public power from 6-percent of installed capacity in 1930 to 24-percent last year.

Referring to his company's plans to construct transmission lines to market Utah's share of Colorado River project power, he declared that if the Federal government insists on building the lines, various



agencies supported by taxes would by 1970 lose over \$500,000 annually, of which nearly 70-percent would go to schools.

Kitchen Carnival Promotion Hits Peak Tempo In April

Edison Electric Institute's All-Electric Kitchen Carnival promotion is in the midst of a two-month industry-wide activity in selling major electric appliances for the home. During March and April, newspapers across the country, national consumer magazines and trade journals are helping electric utilities, dealers, distributors and manufacturers to promote the All-Electric Kitchen Carnival.

Electric utilities locally are sponsoring advertising and promotional campaigns in their service areas making use of newspaper lineage. A Kitchen Carnival kit promotional and other promotional aids will help merchandise the event locally, while supporting ads and themes will be carried by the Live Better Electrically Program in Saturday Evening Post March 5 and April 30 and Life Magazine March 28 and April 11.

Reprints of the LBE trade ad or merchandiser serve as presentation pieces in encouraging distributor and dealer support.

Utility Stocks—Too Good To be "Least Understood"?

"Utility stocks are less understood by investors than any other group of securities," in the opinion of Frederick W. Page, a partner of J. & W. Seligman & Co., and vice-president, Tri-Continental Corporation, the nation's largest diversified closed-end investment company.

"I believe that the investing public is completely misinformed both as to what can be obtained from an investment in an electric utility stock and the basic financial factors contributing to the investment merits of such stocks," Mr. Page recently told a private group of business and financial men.

Mr. Page listed "among the more prevalent misconceptions" the beliefs that (1) utility earnings are hurt by inflation, (2) tight money conditions have a particularly harmful effect on utilities, (3) utility stocks are defensive in character, and therefore, should be bought only at times of uncertainty, and (4) utility stocks are income producers but have very limited growth potential.

Mr. Page declared, "It is evident that there are many utilities whose records would support the popular concept that utilities are defensive and sluggish and do relatively poorly during inflationary stock market conditions. "However," he maintained, "it is equally evident that there is a large group of selected electric utilities that, because of their superior earnings trend, can keep pace with the best of the industrials and can outperform the averages over a period of time."

On the average, he declared, the electric utility stocks in Tri-Continental's portfolio "have shown for the past ten years an earnings growth trend that is twice the rate of the Dow-Jones Industrial stocks. As an outstanding example, Florida

Power & Light's per share earnings during the 1950s grew at a faster rate than did those of Minnesota Mining or Minneapolis-Honeywell, two widely-accepted growth companies," he observed.

The features of these stocks have not been fully recognized by investors, Mr. Page suggested. However, "I am confident that over a period of time . . . the merits of utility growth stocks will be more fully reflected in the market."

To support his view, Mr. Page asked, "Where in the industrial field can you find stocks of companies with a 10-percent to 16-percent earnings growth rate selling at 20 to 24 times earnings. IBM, with a slightly better growth rate of 18-percent, sells at 49 times earnings. Minnesota Mining, with a 14-percent growth rate, sells at 44 times earnings. Minneapolis-Honeywell, with an 11-percent growth rate, sells at 31 times earnings. General Electric and Dow Chemical, with growth rates of 8½-percent and 11-percent, respectively, sell at 26 times earnings."

"I will not even mention the fantastic price-earnings ratios of some of the smaller electronic or space stocks. All of these industrials which I have mentioned are subject, in varying degrees, to cyclical influences, competition, technological developments, or style changes. In contrast, utilities, which lack these risks to any important degree, can be bought at much lower price-earnings ratios."

"It is my opinion," Mr. Page concluded, "that over a period of time the price-earnings ratios of the growth utilities will expand and this, together with rising earnings, will give very favorable market results. The reason for this opinion is that recently the market has weighted the earnings growth factor very heavily. This effort to find growth is based on two basic considerations: High tax rates have made capital gains much more desirable than current income, and the steady erosion of the dollar makes growth essential if the ravages of inflation are to be offset to any degree. Since these two basic considerations are not likely to change at an early date, the market should continue to be greatly influenced by the growth factors."

NPA Group Urges Start On Columbia River Power

Before the U. S. and Canada are forced to turn to much more costly alternative sources of electric power, construction of power-producing facilities on the Columbia River should be undertaken soon enough to provide for needs of the Pacific Northwest by the mid-'60's. "Strong efforts" should be made by both Canada and the U. S. to reach inter-governmental agreement, urged the Canadian-American Committee of the National Planning Association and the Private Planning Association of Canada in a joint statement issued last month.

The statement points out that cooperative development of the Basin would not only unleash tremendous power benefits for both countries but would also result in "considerable flood control benefits."

"In economic terms . . . the most desirable program is one which would produce maximum benefits over costs, with the addition of the most economical projects first, and less economical projects subsequently," the Committee believes.

The first important step towards cooperative development of the Columbia River Basin has already been undertaken—the development of mutually acceptable conclusions within the International Joint Commission as regards the basic principles to be employed in the calculation, maximization and division of benefits to be derived from joint action—conclusions which have not been submitted to the Canadian and U. S. governments.

SEC States Policy On Deferred Tax Accounting

How to indicate in financial statements the credit arising when deferred tax accounting is employed—a question many a tax accountant has pondered—has finally been clarified by the Securities and Exchange Commission. On February 29 the SEC released "a statement of administrative policy" advising interested parties of the recommended procedure.

SEC statement concludes: After April 30, 1960, any financial statement filed with this Commission

The next step, according to the National Planning Association, following governmental review of the I.J.C. report in both countries, will have to be the negotiation of a suitable framework for cooperative action, including the designation of appropriate entities to work out necessary arrangements under principles accepted by the two governments.

"There would still remain many problems of an administrative, legal and operational nature to be solved. But these could probably be solved without undue delay, assuming a basic willingness on the part of all interested parties to get on with the job. As a result, power could flow from a joint development program to meet the growing power requirements on the Pacific Coast by the mid-1960's."

The statement had this to say about downstream benefits: "We are agreed that the upstream country is entitled to a fair share of downstream benefits in return for providing regulated flow. We also agree that, under any cooperative arrangement, both countries should be interested in making "the pie of benefits" to be divided as large as possible, and that the size of this "pie" will depend on the timing and selection of projects to be constructed. The best results can be obtained if those projects yielding the greatest benefits over costs are constructed first, and we believe that this criterion is already being more broadly recognized on both sides of the border as a practical guide for the selection and timing of projects.

"Regarding the equitable sharing of benefits from cooperative action,

which designates as earned surplus (or its equivalent) or in any manner as a part of equity capital (even though accompanied by words of limitation such as 'restricted' or 'appropriated') the accumulated credit arising from accounting for reductions in income taxes resulting from deducting costs for income tax purposes at a more rapid rate than for financial statement purposes will be presumed by the Commission to be misleading or inaccurate despite disclosure contained in the certificate of the accountant or in footnotes to the statements, provided the amounts involved are material."

Columbia River Power?—B. C. Electric Plans New Capacity Before and After

What is the water power potential of Western Canada, and what's being done to utilize it?

With a number of key actions being taken in recent months, the total picture of electric power in this part of Canada and its relationship to the U. S. in the Pacific Northwest becomes increasingly prominent.

First, as is well known, about one-third of the hydraulic resources of Canada and the U. S. is associated with rivers and streams which rise and flow through the Western Cordillera of North America to the sea. British Columbia has over 30-percent of Canada's total possible hydro-electric development of some 30-million kilowatts. Less than 3-million kw of this has been harnessed so far.

Add to B. C.'s 3-million kw the 5-million installed electrical capacity of Washington and Oregon, and the Pacific Northwest has a present total of over 8-million kw. But, with

the proposed development of the Columbia (see accompanying article), the Peace and the Fraser Rivers, B. C.'s installed capacity would be approaching 18-million kw, and the Pacific Northwest on both sides of the border would then have generating capacity in excess of that of all Canada today.

(As EL&P reported in Jan. 1, 1960, the U. S. and Canada had reached agreement on a final draft of principles to be applied in the determination and apportionment of benefits—including power—from cooperative development of the Columbia River. At the same time, B. C. Electric's board of directors okayed final plans for undertaking a 4-million horsepower Peace River hydro project, with a definite start in 1960.)

However, since it is unlikely that power will be available from these rivers before about 1967 or 1968, other provisions for power must be and are being made. Last month, for example, workmen started as-

sembling Western Canada's largest turbine generator—a 157,000-kw steam driven unit for B. C. Electric's Burrard Station, near Vancouver. By the mid-60's this plant is to have a 630,000-kw capacity from four such units.

When completed, this plant will be the major power source for B. C. Electric. Then, if there is no hydro power available from one of the big rivers running through this Westernmost Canadian province, B. C. Electric would be expected to add two more steam-driven generating units to the Burrard plant, with the 945,000-kw total capacity representing a total development cost of \$100-million.

(Metropolitan Vickers, now a part of Associated Electrical Industries, Ltd., is building the four turbine-generator sets on a \$16-million contract that makes one of the largest electrical export orders ever placed in the U. K. Natural gas is to be the main fuel, with a variety of oils available as secondary fuels.)

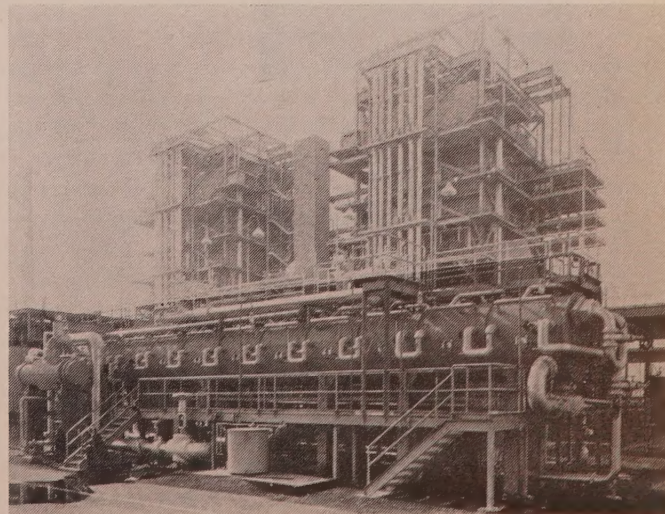
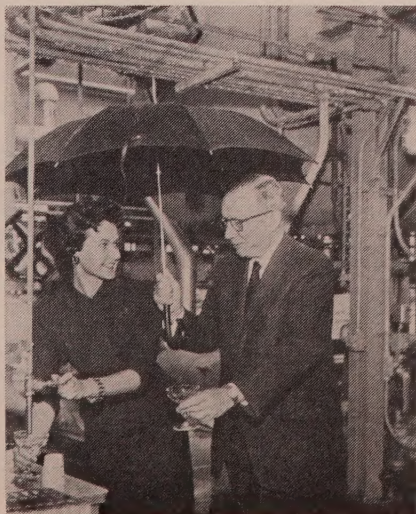
the primary principle suggested by the I.J.C. is for the upstream country to agree to provide regulated flow at the boundary in return for an equal share of the downstream power benefits delivered at the border. That is, the gross power benefits would be divided equally, with each country bearing the costs within its own borders, and with the benefits essentially calculated as the increments of power production made possible through upstream storage."

The statement also proposed this solution: "While the power benefits are the most important, there are also considerable flood control benefits. In most cases the flood control can be provided without any loss of power. Since the flood control benefits accrue in the United States and the service is provided by Canada, it is necessary to determine what constitutes reasonable compensation for this service. Here again, it would appear appropriate to accept the principle of an equal sharing of

benefits, such benefits perhaps to be calculated (on the part of U. S. authorities) as the value of flood damage prevented."

The statement notes that "an equitable and mutually acceptable joint program for the Columbia would help to lay an appropriate basis for subsequent development of other international rivers—not only rivers crossing the Canada-U. S. border, such as the Yukon River, but also various international rivers in other parts of the world."

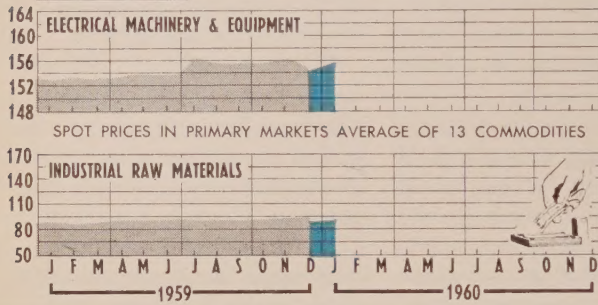
The first general purpose sea water conversion plant on the Pacific Coast (and first in the U. S. to operate with a steam electric station) started up recently near Oxnard, Cal. First official taste of the freshened Pacific Ocean water goes to So. Cal. Edison's V-P W. L. Chadwick. The \$250,000 converter (at right) is expected to demonstrate size and other factors necessary for plants with capacities of 5 - 10 - million - gallon - per-day.



MARKETING GUIDEPOSTS

INDEX OF PRICES

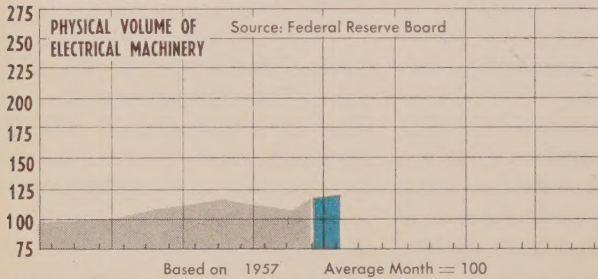
Source: U. S. Dept. of Labor (1947-1949 = 100)



ELECTRICAL MANUFACTURING

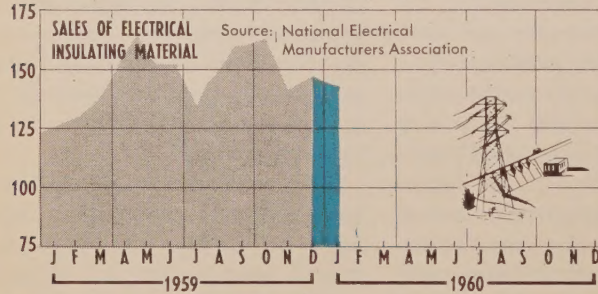
PHYSICAL VOLUME OF ELECTRICAL MACHINERY

Source: Federal Reserve Board



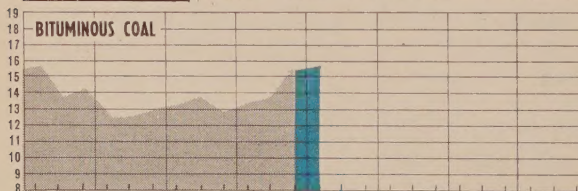
SALES OF ELECTRICAL INSULATING MATERIAL

Source: National Electrical Manufacturers Association

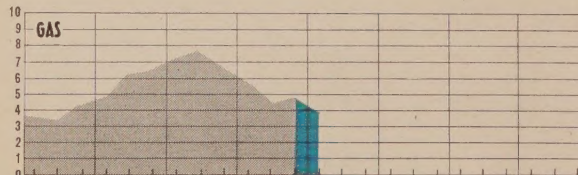


FUEL CONSUMPTION

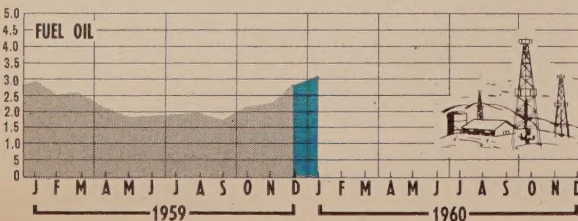
ELECTRIC UTILITIES Source: Federal Power Commission



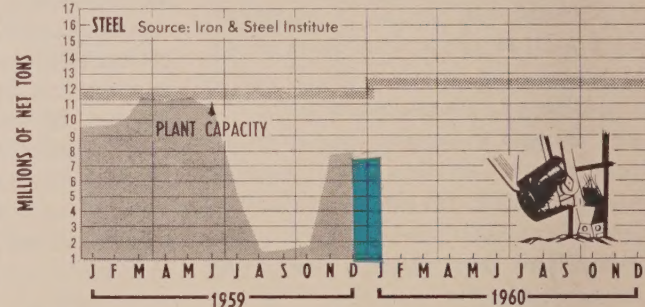
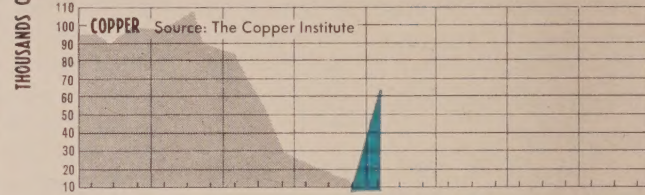
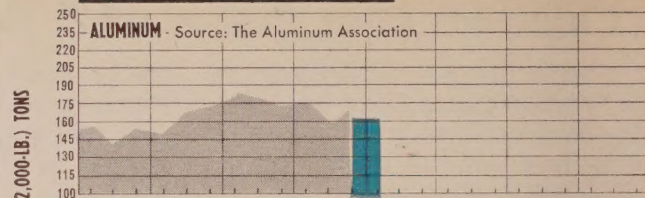
GAS



FUEL OIL

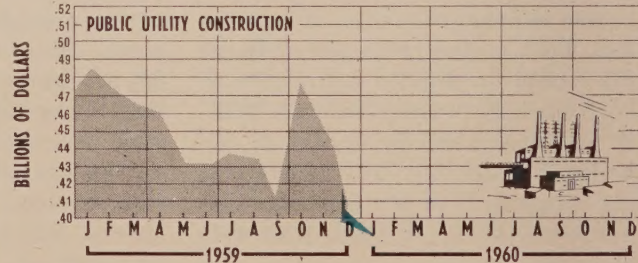
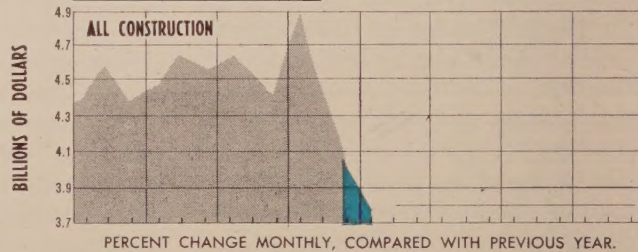


U. S. PRODUCTION OF PRIMARY METALS



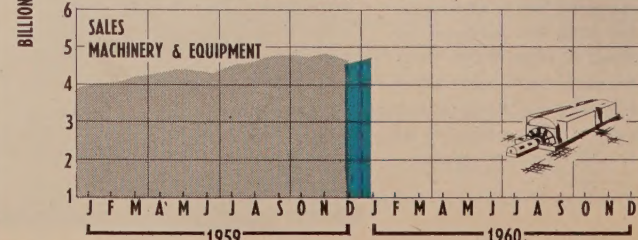
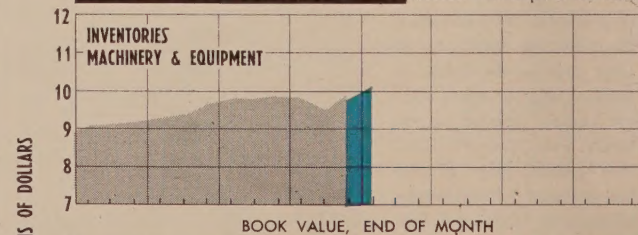
NEW CONSTRUCTION ACTIVITY

Source: U. S. Dept. of Commerce



MANUFACTURERS' INVENTORIES & SALES

Source: U. S. Dept. of Commerce





by RALPH ELLIOTT
Washington Editor

With Grass-Roots Support, Boggs Bill Has A Chance

Grass roots pressure for enactment of the Boggs bill, which would guarantee the right of individuals and businesses to support or oppose legislation without incurring a federal tax penalty, has been mounting at a surprising rate over the past few weeks. There now appears to be some chance—although at best a slight one at this time—that the bill, or perhaps some modified version of it, could be enacted this year.

Specifically, the Boggs bill (H.R. 7123) would nullify Internal Revenue Service regulations which disallow for tax purposes any expenditures for lobbying or for advertising related to political matters. The measure thus would settle once and for all the controversy kicked up in recent years over whether the government should be allowed, through its taxing powers, to put a price tag on freedom of speech.

The controversy was touched off early in 1957 when Senator Kefauver insisted that IRS rule on the deductibility of contributions to the Electric Companies Advertising Program. Consequently, for more than two years the merits of an attempted defense of a fundamental freedom were largely overshadowed by the highly emotional issues involved in public vs. private power. But this is no longer the case. Sources of the demands that have been pouring into Capitol Hill for remedial legislation demonstrate a widespread realization that the basic issue involved is of deep concern to just about every form of taxpaying American business.

And now those demands are beginning to bring action. Looking to the probability of holding hearings in the near future on the proposed legislation, chairman Wilbur Mills of the House Ways and Means Committee—of which Boggs is a high-ranking member—recently request-

ed the views of the Treasury and Commerce departments.

The response of Commerce Secretary Frederick Mueller was an all-out endorsement of the Boggs bill. "A realistic solution to the problem will be found only in appropriate legislative changes," he said. "We feel that the sound policy would be to permit full deduction for all lawful expenditures that are related to the business of the taxpayer."

Mueller emphasized that "The impact of Government has become so pervasive that businessmen and the organizations which represent their interests often find it necessary to convey to legislative bodies and to the public their views regarding existing or proposed legislation. Freedom of expression is an essential element of a free economy."

Treasury Under Secretary Fred Scribner submitted a far more voluminous and detailed reply. He said the department recommends "early consideration" of legislation "designed to modify the bar to deductibility of expenditures in connection with the legislative process." Between the lines, however, was an unmistakable indication that the department feels the Boggs bill is too broad.

A "reasonable" approach, Scribner said, would be the allowance of deduction of "reasonable expenses directly connected with appearances and submissions at public hearings" before legislative committees. "Broader legislation may well be indicated," he agreed, but should be examined in the light of various "policy considerations" and the possible need for statutory safeguards against abuse.

A possible source of strong and effective support for legislative action is seen in organized labor. Al-

though none of the major labor unions has openly taken a position with respect to the Boggs bill, several of them, including the AFL-CIO, vigorously opposed the present lobbying regulations during IRS hearings on them last November. AFL-CIO counsel told IRS that "political activity is as normal a part of labor activity as collective bargaining."

Under the circumstances, it will be surprising, indeed, if the unions do not throw their support behind some form of remedial legislation.

Meanwhile, Boggs is ready for action and is pushing for early hearings on his measure. In a speech to the House last month he declared:

"No tax law, or administrative interpretations, should be permitted to stand that would impair the ability to communicate freely to all sections of the public or elected representatives, views on legislation affecting the economic lives of our citizens, either through advertising, membership in an organization, distribution of literature, or any other form of lawful communication."

He said "It is all very well for some to say that tax sanctions imposed on communicating with Members of Congress, either directly or indirectly, do not abridge First Amendment rights, but simply makes the cost of such activities nondeductible for tax purposes. However, those who hold these views, if they be practical men, realize that the imposition of punitive taxes is one of the most effective deterrents to the exercise of the constitutional rights of every citizen to freely express his views."

The measure already has an impressive amount of nonpartisan support. To be enacted, however, it must have much more—and it must be from the grass roots.



NEW ENGLAND WILL BE FIRST area in the nation where atomic electricity will become competitive, Yankee Atomic Electric's Pres. Wm. Webster noted in his presentation for the recent AEC license application hearing. He predicts that the plant at Rowe, Mass., will be in operation by July 1, a month ahead of the planned schedule.

NUCLEAR MATERIAL INVENTORIES must be reported semi-annually by most but not by all holders, according to a new AEC regulation. Exception: . . . any licensee who during the six months preceding June 30 had losses or burnup of less than ten grams of special nuclear material and did not receive or transfer any special nuclear material, or financial responsibility therefor, is required to file only an annual report as of Dec. 31."

VALLECITOS REACTOR LICENSE, subject of a new hearing on April 5, will be continued, if the recommendation of the AEC's Reactor Safeguards Committee is followed. The Committee "believes the plant can be modified as proposed . . . and operated without undue hazard to the health and safety of the public." The Committee anticipates satisfactory operation of the control rods in a newly proposed fuel arrangement ("because of the applicant's past experience with this type of mechanism . . . and his stated intentions"). And, the Committee believes that "the worth of the control rods for each substantially different core should be measured and evaluated during core loading in terms of the excess reactivity possibly available in that core loading, and in terms of any possible malfunction of the control rods to insure an adequate shutdown margin under foreseeable conditions."

FIVE POWER REACTOR PROJECTS were the subject of AEC hearings in the period from mid-November of 1959 through January of this year, the Commission notes in a release on "highlights" of its licensing activity.

GAS-COOLED REACTOR TEST at the National Reactor Testing Station in Idaho has been in operation since the end of February. As a step in the development of a small mobile reactor and power conversion system for the Army, the experiment is aimed at advancing the first U. S. direct- and closed-cycle gas-cooled reactor system.

HIGH-EXPLOSIVE TESTS in the 17- experiment series conducted underground in a Louisiana salt mine were completed last month. Seismic effects of the non-

nuclear explosions were measured. A new series was to have been started in Nevada volcanic rock about the end of March.

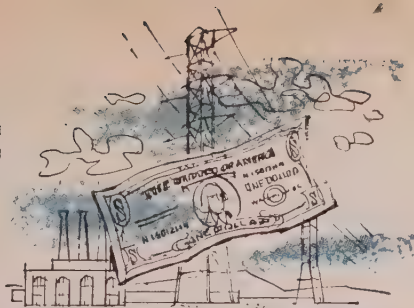
"TO CONSOLIDATE B & W EXPERIENCE and align our capabilities with the type of nuclear business we expect in the future," according to Dr. L. M. Currie, Babcock & Wilcox has reorganized its Atomic Energy Division. In it, M. C. Edlund heads a Development Dept., R. P. Grimes heads a Contract Dept. and D. A. Plunkett supervises a Proposition Dept. Senior Technical Advisor is W. M. Breezeale.

NUCLEAR TRAINING ACTIVITY—In February, Georgia Power Co. graduated 32 engineers from its second nuclear engineering course (of 52 weeks); and the 12-man supervisory staff that is to be the nucleus of the operating organization for Consumer Public Power District's Sheldon Station is now undergoing an extensive 21-week training course, part of which is being spent in Canoga Park, Cal., at Atomic International facilities.

REACTOR SAFEGUARDS COMMITTEE OK has been given to the Yankee Nuclear Power Station and to "a reactor of the general type" of the Parr, S. C., atomic powerplant, sponsored by the Carolinas Virginia Nuclear Power Associates. The Committee has agreed that continued operation of the pressurized light water-moderated Yankee reactor can be permitted, without undue hazard to the public, even with leakage from the primary to the secondary system.

IN NEW YORK, STATE PARTNERSHIP with private utilities in atomic power development was recommended by the state's office of atomic development. But, omission of the State Power Authority from the plan angers the latter agency, which argues it wishes "to contribute its share." (Meanwhile, in the Niagara Falls, municipal officials are on record as favoring private ownership of a nuclear power plant proposed for construction in that area.)

UNCLAD FUEL ELEMENTS of "The Turret" reactor at Los Alamos are to be set in a revolving core that will simplify recharging and assure more complete burn-up. The elements will consist of uranium-impregnated graphite porous enough to permit escape of the fission products into the coolant (helium gas), which will carry these products away. In refueling, spent fuel elements will be pushed out of their channels in the rotating core, new ones replacing them—while the reactor continues to operate.



by A. C. FARMER
Economic Consultant

Gold and the American Economy

There is no doubt at all that the continued decline in the volume of the gold stock of the United States has become a subject of increasing concern to the financial authorities of the United States Government. During the year 1959 the gold stock of the United States was reduced by over one billion dollars, and this reduction continues. A comparison of the figures from December 1958 to December 1959 are as follows:

	Gold Stock Dollars in Billions	Bank Deposits plus Currency
December 1958	\$20.563	\$245.5
December 1959	19.482	251.2
Change	-1.081	+ 5.7

The ratio of the bank deposits plus currency to the U. S. gold stock increased to 12.9 at the end of 1959.

On the chart there is shown the changes in the U. S. gold stock, the changes in bank deposits plus currency, and the changes in the ratio of these two items from the year 1929 to 1959. From this chart it seems clear that the volume of money represented by bank deposits plus currency continuously will be increasing, while the gold stock fails to increase, and recently has been showing a steady decrease.

The current claims of foreign governments on the U. S. gold stock, if exercised, would leave the United States with a gold stock of not more than \$3.5 billion. In a discussion of this subject which appeared in the issue of February 15, 1959, the following statement was included and still obtains:

"Events now are proving that it is impractical to have an elastic currency for domestic use and a rigid price for gold for international use. With the volume of credit dollars, represented in the United States by bank deposits plus currency, continually expanding—and with the volume of gold stock remaining practically unchanged, it is obvious that the danger is present at all times for the United States to lose a substantial portion of its gold stock."

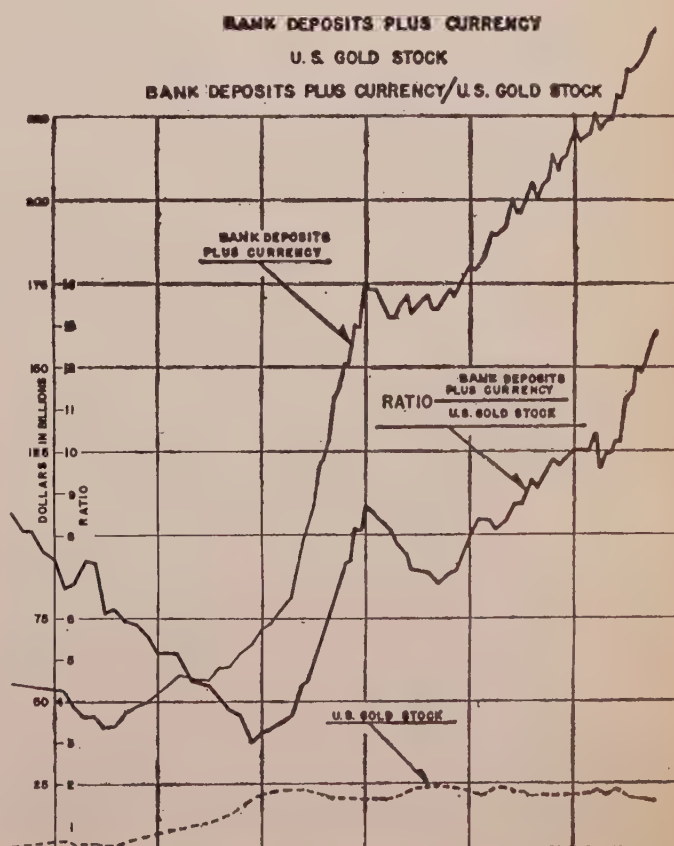
The continuous increase in bank deposits plus currency results basically from the operation of various government agencies, which are authorized to approve the borrowing of money by private individuals or groups, and not, as commonly seems to be accepted, from the direct action of the Federal Reserve Bank. Agencies authorized to approve the borrowing of money in large amounts are, for example, the Housing Authority, through which billions of dollars are authorized every year for the erection of homes, and through the Farm Authority, through which billions

of dollars every year are authorized for the purchase and storage of commodities. The borrowed money finds its way into the banking system and appears either as demand deposits or time deposits. There is no way of controlling the expanding volume of bank deposits plus currency as long as these current domestic programs are continued.

High interest rates operate as a deterrent to expanding loans, and high interest rates operate also as a deterrent to the loss of gold stock.

It is probable, therefore, that the present high interest rates that are being maintained are intended by the monetary authorities not only as a preventive to higher prices, but, even more importantly, as a deterrent to the further loss of the gold stock of the United States.

The reason why the gold stock of America has assumed and will continue to assume a greater and greater importance in the American economy and in the minds of those who control its monetary policies, is the fact that any substantial loss of gold could act as a trigger that would result in the transfer of money from fixed income securities to equities on a scale that could be disastrous.



NUCLEAR POWER—

The Role of the CONSULTING ENGINEER

By R. H. GORDON

*Project Engineer,
Nuclear Engineering Division,
Ebasco Services, Incorporated*



Ebasco Engineering Vice President, W. H. Colquhoun (center), reviews project plans with L. F. C. Reichle, nuclear engineering director, (l.), and R. H. Gordon (author), nuclear project engineer. Ebasco completed 14 major design and construction projects in 1959.

TODAY, the utility industry is facing a fresh challenge in making effective use of nuclear fuels in producing electricity. A new set of technical, political and economic factors present themselves. They must be evaluated on a long range basis in order to select the best course to be followed by the utilities in the public interest.

Managements of electric utilities, beset with the everyday problems of operating a huge energy system and producing reliable economical service, should, as before, look outside their companies for assistance to evaluate nuclear power concepts and expected growth and, when justified, utilize this source of energy in their system expansion.

To whom shall they turn but their trusted and reliable counselor—the consulting engineer-constructor*. For to achieve the industry's prime goal, the consulting engineer has, over the past 50 years, counseled the utility industry in selection of fuel, utilization of higher steam pressure and temperature, acceptance of advances in steam generation and its conversion into electric energy, and in efficient transmission, distribution and utilization of the end product.

Together, the electric utility and the consulting engineer have contributed toward the creation of a climate which motivates the manufacturer to develop more efficient, reliable, larger and more economi-

cal component equipments. The teamwork exhibited by these groups—the utility, the engineer, the manufacturer—has resulted in maintaining almost constant average electric energy costs from 1940 to 1958 despite a loss of more than 50-percent in the purchasing power of the dollar in this same period.

What, then, must the consulting engineer do to equip himself and serve his client in this new direction?

Technological Reorientation

The consulting engineers' colleagues, the research scientists—physicists, chemists, metallurgists—are developing and demonstrating fundamental nuclear terms, laws and processes. The familiar concepts of coal pulverization, coal-air transport and combustion, flame pattern, heat release and absorption per unit of furnace configuration and coal and ash handling have such functional nuclear counterparts as fuel pelletization and enrichment, power density, irradiation level, coolant reactivity, fuel element design, storage and handling, spent fuel processing and waste disposal. Thus the consulting engineer must, at the outset, begin new educative processes. Today we find the consulting engineer, along with the manufacturers, in the midst of this educational phase in the development of nuclear power.

The research and development branches of large manufacturing companies have invested large amounts of time and money to study and produce commercially sound equipment to generate steam

from nuclear fuel. This effort has been supported or supplemented by (a) large governmental expenditures for fundamental research and development both in the laboratories and in experimental facilities and (b) utility support of various developmental and construction programs. As a result, in the U. S. two commercial nuclear power stations are in operation and several others are in the design, construction or pre-operation phases.

Within this developmental climate the consulting engineer, in addition to fulfilling his responsibilities to utility clients engaged in nuclear undertakings, is also serving as consultant to:

The Atomic Energy Commission—to:

- Evaluate alternate reactor concepts and applications.
- Engineer, design and in some instances construct reactor plant, supporting facilities and process systems.

The Manufacturers—to:

- Study reactor applications.
- Engineer and design and in some cases construct quasi-experimental stations.
- Engineer and design elements of commercial "packaged" stations for which the manufacturer has consummated contracts, generally outside the U. S. A.

Both the AEC and the major manufacturers have recognized the indispensable position of the independent consulting engineer in the furtherance of practical nuclear power. With this recognition and

* The term "consulting engineer" as used herein is intended in the broad sense to include those professional organizations qualified to provide business, engineering, design, purchasing and other consultant services. In many cases such firms also provide project construction services.



Group discussion, an important part of the work of consulting engineers, brings together key personnel associated with a nuclear project done for Knolls Atomic Power Laboratory (l. to r.): S. Sparacino and L. Schneitter, mechanical engineers; C. A. Streifus, nuclear project engineer; and R. G. Ganahl, coordinator.

the subsequent key assignments in this infant industry, the consulting engineer is getting familiar with the nature of nuclear terms and processes, while furthering growth of the new art.

Thus we can state the first role of the consulting engineer—namely **to assimilate and express in terms meaningful to the utility the fundamental concepts utilized in nuclear generation of electricity.**

Evolutionary Economics

The consulting engineer as the most impartial and most experienced in overall power-plant economics, must attain a position of leadership in the industry by formulating reliable data and reasonable programs based on realistic technical and economic study. To formulate such data he should analyze the most advanced nuclear equipment and fuel designs available at today's level of technology and determine the attendant range of cost at which electricity can be produced. Applying his judgment and foresight, he should then predict the rate at which these costs may be reduced, focusing his attention on the elemental forces in effect, or those required to achieve and even accelerate these cost reductions. Furthermore, by utilizing the nuclear experience gained from his many assignments in this young industry, he should also explore the relative merits of different reactor cycle concepts and systems. As a professional practitioner, consulting engineer can do all this with a skilled, unbiased, imaginative mind.

Thus, we can state the second role of the consulting engineer, namely **to estimate and predict nuclear energy cost ranges now and in the foreseeable future and to emphasize concepts with merit deserving full developmental attention.**

The utility management, utilizing the consulting engineers' evolutionary economic data, may then assess (without regard to other factors to be discussed later) the cost to utilize nuclear fuels today, its effect when it will be economical and the areas in which to support research and development.

It is generally known that the present prediction of consulting engineers, manufacturers and the AEC are not optimistic on the general competitive economics of nuclear power over the next five years, although prognostications to 1970 appear favorable. If it were not for the effect of other influencing

factors, discussed below, the consulting engineer's role might be confined to maintaining his technical association with and guidance of nuclear research and development and to periodically reevaluating energy costs until such time as competitive economics are achieved. However, the other factors in this complex picture call for a broader course of thought and action.

Other Influencing Factors

The unusual interplay of forces tending to accelerate development of the nuclear art beyond what would normally be expected as a result of basic "market-demand economics" are:

1. **Public Benefit**—to realize the promise of lower energy costs as soon as possible and to firmly establish nuclear materials as long-term usable fuel reserves.
2. **International**—to maintain the U. S. position as world leader in nuclear technology thus illustrating the advantage of belonging to the "free world," and to maintain our national pride.
3. **Military**—to maintain our defensive and retaliatory power far beyond that of any possible aggressor.
4. **Leadership**—to gain leadership in nuclear technology and its application since this field represents an enormous future market.

It is hoped that these forces can be effectively integrated to achieve the broad benefits of nuclear energy. With such effective integration, the government, the utility and the manufacturer will be ex-

R. H. Gordon, the author, discusses optimum nuclear plant arrangements with Ebasco Engineers (l. to r.): P. J. Carr, T. A. Flynn, E. J. Conway, Dr. H. C. Ott, and R. L. McAuley.



posed to healthy motivation and the economic evolution of nuclear power should be accelerated to the eventual advantage of the public. On the other hand, undue emphasis on any single factor might dominate the development program and hamper achievement of the overall objectives. For example, if nuclear technology and manufacturing know-how becomes concentrated and for commercial reasons nuclear plants are offered principally as a manufacturer's package, the utility might then lose the benefit of the impartial professional consultant's evaluation and optimization of nuclear systems and components and their subsequent design—all for lowest cost and maximum reliability and safety. As another example, a program which primarily satisfies our national pride might unjustifiably consume our financial and personal resources for the profligate construction of nuclear plants.

Grasping the nature of these forces, the consulting engineers' third role is apparent—namely to anticipate their manifestation, to assist in their effective integration and to advise the utilities how best to conduct their operations in harmony with the nuclear activities of others.

To date, encouraging progress has been made by the electric utilities, either alone or in groups, to advance nuclear technology by embarking on certain experimental, prototype and study projects. As such action continues, the guidance of sound technical and economic knowledge is essential. This calls for the impartial consulting engineer.

The Utility and the Engineer Must Lead

In fulfilling his third role, the consulting engineer must determine first and foremost how best to expand the utility industry's initial ventures in nuclear power.

Today pioneering nuclear plants utilizing concepts and designs formulated from reasonably well proven technology are being constructed. Extrapolation of these designs and concepts and, of utmost importance, refinement of these de-

signs appears to be the most fruitful area for immediate future activity. Such activity obviously entails considerable research, product development, design and engineering work followed by construction of second- and third-generation plants. The cost of such activity in the near future will be high and the utility must recognize the possibility of economic penalty in the immediate pursuit of its objective. Industrial history of the development of new concepts to a commercially attractive and marketable stage has shown that there are no alternatives to the high price of knowledge.

Thus, the fourth role of the consulting engineer emerges—namely to select nuclear plants optimized with respect to size and reactor system primarily to minimize economic penalty, but at the same time to diversify exploration of alternate concepts to promote technological and economic progress.

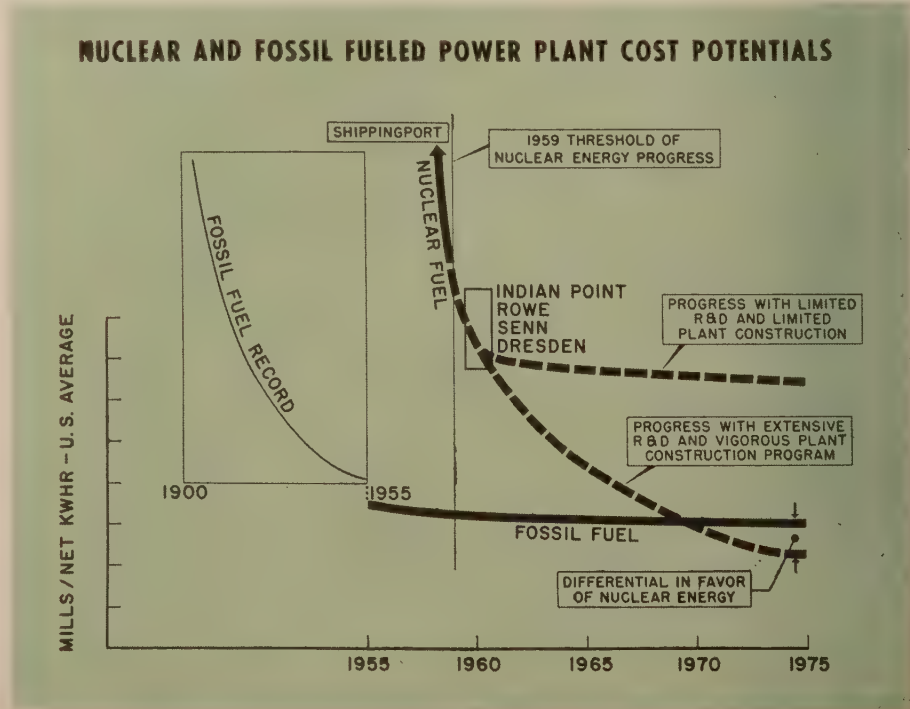
The consulting engineer in fulfilling his fourth role must serve his utility client as follows:

1. Select the unit size and reactor system considering firstly, the size required to suit the utility system growth; secondly, the desirability of avoiding obsolescence for as long as possible and; thirdly, the need for obtaining reliable data for projection of size

and concept and for future refinement of design details.

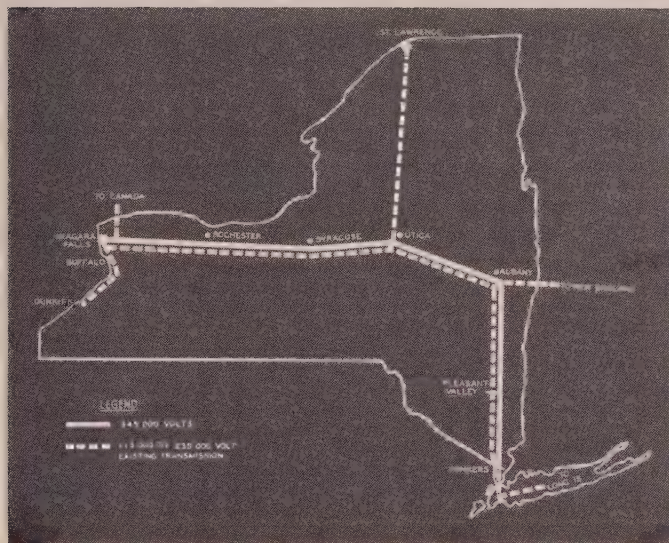
2. Engineer, design and supervise construction of the plant purely as a "kilowatt-hour factory" to realize minimum cost within the safety requirements of the nuclear station. This, of course, also entails site selection and hazard analyses.
3. Incorporate economic design refinements where current experience indicates the feasibility of such refinements.
4. Incorporate design flexibility in areas where anticipated future modifications might yield either significant operating cost savings or valuable data for future plant designs.

As the consulting engineer-constructor fulfills his fourth role, the nature of his total contribution in serving the utility industry is seen as a whole namely to utilize his experience and resources, as he so ably does on conventional plants, in leading the way toward development of this new art at the fastest possible pace to achieve the aims of Low-Cost Power for the Public; Long-Term Economic Fuel Reserves; National Defense and Pride; International Prestige; Diversified Industry Leadership.



Nuclear "learning curve" appraising the prospects for nuclear power demonstrates Ebasco's concept of the future for nuclear energy, illustrating the effect of "vigorous activity."

New 345-kv Backbone For New York State



By July 1, 1962, four times as much power will be able to flow between Con Edison and Niagara Mohawk than flows through the present 138-kv, 200-mw interconnection.

Adding 600-mw capacity and more closely cementing the systems will be a 345-kv backbone between Yonkers and Utica. Cost will be \$35-million. At Utica the new lines will link with those now under construction by New York State Power Authority between that city and Niagara Falls.

Reclosers Play Network Protector Role

Three reclosers are helping Central Power & Light maintain a high degree of service reliability on two lines to a carbon-black plant near Corpus Christi, Texas. Two of the three Westinghouse PR reclosers act as network protectors on the two 12-kv lines. They are factory-wired to operate with two special control units designed by Westinghouse engineers.

If a fault occurs on either line, the recloser associated with that line opens by a reverse-power relay. The substation circuit breaker then operates under supervision of a reclosing sequence—either to lock out or reclose if the fault clears. If the fault clears, the breaker will reclose, restoring normal voltage which is recognized by the control unit, and the recloser will re-establish dual feed to the customer.

The control unit contains relays to detect reverse power presence of normal voltage and a time-delay

closing. A capacitor trip device trips the recloser after reverse power has been detected.

The third recloser is used as a switching device on the feeder to the carbon plant.

Multifueled Diesel Engine Shines In Tests

Army Transportation Corps reports superior performance of a versatile, multifueled diesel truck engine, burning anything from Army gasoline to kerosene or marine diesel fuel, in competition with a standard gasoline engine.

During tests, two M-48 standard two-and-one-half ton Army tractors were used: one used conventional gasoline power; the other replaced the gasoline engine with a heavier multifuel diesel installation.

Army gasoline, JP-r fuel, kerosene, standard diesel and marine diesel fuels were successively burned by the diesel rig.

Said ATC, the new multifuel diesel plant demonstrated "a significantly lower fuel consumption rate than the standard gasoline engine." With kerosene or either grade of diesel fuel, the multifuel engine "greatly outperforms the standard M-48 truck."

Is Wood Practical For 345-kv Support?

Answers to this question will be sought from a 345-kv test line to be built soon by Illinois Power Co., on the site of Indiana & Michigan Electric Co.'s Breed plant. Cooperating will be AEP Service Co. engineers and several line-equipment suppliers.

The line will operate open ended and will not carry load. Its one-mile length will consist of six or seven wood-pole H-frame structures. Several crossarm configurations will support a three-phase, horizontal configuration circuit using 1414-mcm expanded ACSR (single conductor per phase).

Structure design will allow phase-to-phase spacings and numbers of units per insulator string to be altered as tests progress. Studies and tests may go on for as long as two years.

Studies will include: leakage currents over insulator strings and their effect on the burning of wood supporting members; three-phase electrostatic fields and their effect on corona production on the line and conductor hardware, and the problem of maintenance and insulator replacement with the line energized.

Breed station was selected as the test site because facilities are available there to energize the line at 345-kv and carry on the test on a three-phase basis.

SERIES CAPACITORS ON 12-KV FEEDERS . . . AN 11-YEAR RECORD

By
D. C. KEEZER,
Electrical Engineer,
Pacific Gas & Electric Company

Experience with 15 installations on the PG&E system has shown the line-type series capacitor to be an effective and economical means for controlling voltage fluctuations and increasing the voltage stability limit of distribution feeders.



Fig. 1—In this early type of installation, slight canting of the entire structure resulted from the eccentric loading when poles were set in soft or wet soil.

SERIES CAPACITORS have found their principal application on the PG&E system in the correction of voltage fluctuations on long rural feeders. The company installed its first 12-kv series capacitor in 1948 and has added 14 more since that time. Performance to date has demonstrated the effectiveness and economy of this type of application.

Voltage fluctuation on rural feeders is a particularly difficult problem because in most instances the revenue from such feeders will not justify the large expenditure required for correction by conventional methods. Experience has shown the need for a careful study of each application for an increase in capacity or for new service to sawmills, dredgers, or similar loads to determine the probable magnitude of primary voltage fluctuations which may result. If the study

indicates a flicker level liable to cause complaints from other customers, various conventional means for reducing voltage dips such as reconductoring, relocation of substation, or even selection of a more suitable location for the load are evaluated to determine their effectiveness and relative cost in the particular instance under study.

A comparison of the costs of suitable corrective measures with the expected revenue may indicate that the prospective load should not be accepted. Note that the installation of a series capacitor is not considered as a means for correcting dips likely to be caused by a load not yet in service.

Test Data Is Essential

Inasmuch as the principal factors which determine the design and performance of a series capacitor are the system impedance at the fluctuating load and the magnitude and power factor of the load increments, it is apparent that a series

capacitor should not be recommended until load characteristics can be determined by test. Tests have shown that the electrical characteristics of manually-controlled loads such as sawmill head rigs and dredgers are more dependent on the method of operation than the type of equipment used and that characteristics of such loads predicted from typical operating curves or theoretical analysis are entirely unsuitable for design purposes.

In order to obtain reliable information for design of a series capacitor, simultaneous high-speed kilowatt, kilovar, and voltage charts are obtained on the feeder with all fluctuating loads and other loads operating normally. The data on these charts will show directly the magnitude and frequency of the voltage dips, and when analyzed in conjunction with the circuit constants will indicate the cause and degree of correction obtainable.

It is important to note that although a series capacitor can be

Editor's Note—This is the essential text of a paper presented by the author at the Sangamo Workshop Seminar, held at Greenville, South Carolina, in November 1959.

very effective in reducing voltage dips caused by the lagging reactive component of load current flowing through inductive reactance, it is relatively ineffective in reducing voltage dips caused by the kilowatt component flowing through line resistance.

Although it has been found that the electrical characteristics of series capacitors must be individually engineered, experience gained during installation of the first few banks pointed out the possibility of standardizing some of the basic construction details. Standardization of the supporting structure and auxiliary equipment (bypass switches, protective devices, and damping resistors) has resulted in repetitive construction and appreciably reduced the cost of recent installations.

As shown in Fig. 2, the supporting structure for the capacitors is a standard two-pole prefabricated platform designed for distribution transformer or regulator banks. The mounting timbers and pillar insulators are arranged to provide even distribution of capacitor weight as well as to provide the levels of phase-to-phase and phase-to-ground insulation required by local climatic conditions.

In the design shown in Fig. 1, the transverse capacitor mounting timbers were installed eccentrically with respect to the centerline of the platform to provide space for the damping resistors. Field experience with this design showed that when the poles were set in soft or wet soil, the moment of the resistors and their mounting insulators sometimes caused a slight canting of the entire structure. The unbalanced moment was eliminated by re-designing the structure as shown in Fig. 2 so that the resistors are mounted longitudinally with respect to the platform centerline. This eliminated the unbalanced moment and resulted in a considerably simplified structure.

By-Pass Protector Required

In a typical series capacitor installation, the voltage rating of the bank is in the order of 15 to 25% of the circuit line-to-neutral voltage. Unless a suitable means is provided to bypass large momentary currents, voltages of several times

rated value may build up across the bank during severe load-side faults. To prevent damage to the individual capacitor units requires a protective device which will operate quickly and reliably to limit voltage rise across the bank to approximately 250% of rated value. These requirements are normally met by some sort of arc gap shunted across the capacitor bank. Under normal conditions no current flows through the gap.

Under abnormal conditions (switching surges, load side faults, etc.) the first instantaneous value of voltage exceeding the setting will flash over the arc gap, reducing the voltage across the capacitor bank to the arc drop value and bypassing the combined load and fault currents around the capacitors.

Protection of series capacitors requires a specially-designed arc gap. It must have electrodes which can withstand persistent fault currents until overcurrent protective equipment can de-energize the line and it must be self-protecting (or protected) against non-persistent faults —i.e., after the fault is cleared the gap must be capable of transferring the load current back to the capacitor or must be protected by auxiliary bypassing contacts. In general, the lines on which series capacitors have been installed are subject to a large number of transient faults throughout the year and often extend into relatively inaccessible areas. Therefore, the self-clearing type gap has been considered essential to minimize costly service calls and extended outages of the capacitor bank.

In its early attempts to find a suitable device for protection of 12-kv series capacitors, PG&E discovered that the moderate cost which could be justified and the comparatively small demand had not provided sufficient inducement for equipment manufacturers to develop a reliable and inexpensive protective device. Laboratory tests and field experience with commercially available protective devices have been unsatisfactory, with little or no correlation observed between cost and performance. From both standpoints (reliability and cost), the most satisfactory protective device used to date has been a cone-gap overvoltage protector originally de-

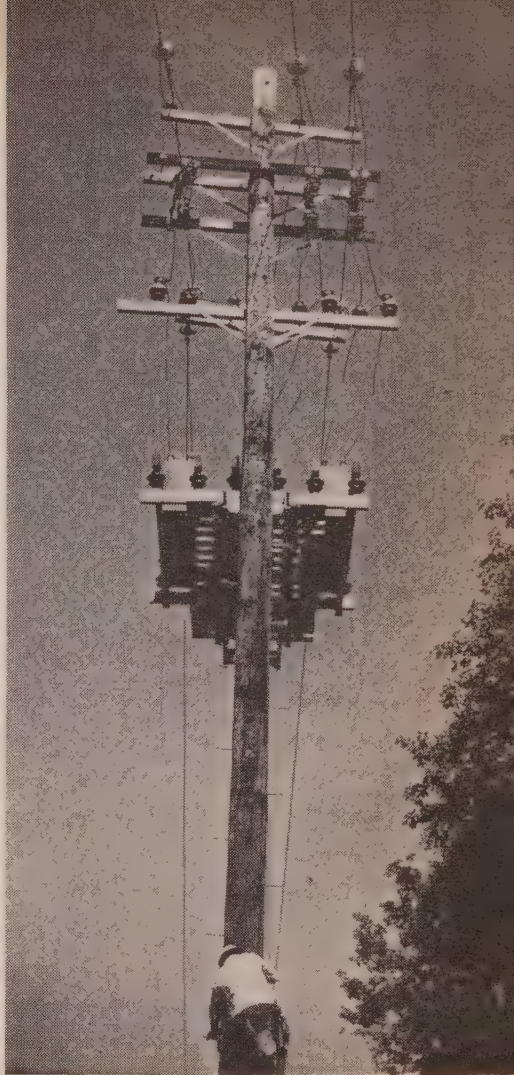


Fig. 2—This re-designed structure eliminated the unbalanced moment encountered with the Fig. 1 design and resulted in a considerably simplified structure.

signed by PG&E engineers for protection of open-wire telephone lines against high voltage.

Fig. 3 shows a sectional view of the cone-gap overvoltage protector. Basically, it consists of a rod passing axially through a cone. The rod terminates in a spiral which has been designed with sufficient mass of bronze to provide good thermal capacity. The instant the voltage across the gap exceeds its breakdown setting an arc is initiated between the rod and cone electrodes. Natural convection currents quickly move the arc upward until it is established between the spiral and cap where motor action causes it to rotate at high velocity. The continuous motion of the arc prevents localized heating and electrode spatter, enabling the gap to withstand currents up to 5100 amperes for a minimum of 12 cycles without appreciable damage.

Tests have shown that the gap

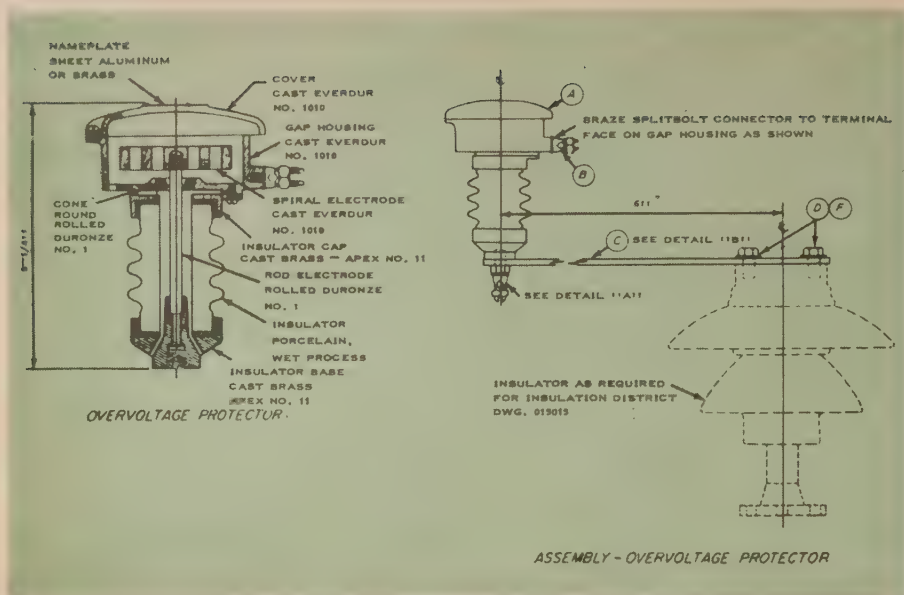


Fig. 3—Assembly drawing of cone-cap overvoltage protector developed for 12-kv series capacitor installations.

will reliably extinguish arcs up to 100 amperes, which means that in locations where the load current does not exceed 100 amperes, it is self-protecting against transient faults. Overcurrent protection against persistent fault currents in the range of 110 to 250% rated bank current is required to prevent damage to capacitor units. The cone-gap overvoltage protectors require similar protection to prevent damage after flashover by persistent fault currents. If, as is usually the case, load between the substation and series capacitor will not permit relay settings low enough to insure that the feeder oil circuit breaker will reliably clear light fault currents before the thermal capacity of the capacitors or cone-gaps is exceeded, an auxiliary overcurrent protective device (recloser, fuse, etc.) will be required for adequate protection of the series capacitor bank.

Existing line-protective equipment, possibly relocated, ordinarily affords adequate protection for the capacitor units and overvoltage protectors. The position of the overvoltage protectors on the structure can be seen clearly in Fig. 4 which is a photograph of a recent installation.

Resistors Damp Oscillations

It will be recognized that the intentional addition of a capacitive reactance, in series with the distributed inductive reactance of a feeder, establishes a potentially res-

onant series RLC circuit. In fact, series capacitors are theoretically capable of causing three different types of resonance—subsynchronous resonance, ferro-resonance, and hunting (with large induction motors). Although subsynchronous resonance has proved to be troublesome on occasion, the other types have not been encountered to date. Fortunately, however, it is not necessary to wait for the condition to develop and be properly identified before an effective remedy can be prescribed. Damping resistors are an effective preventive measure against all three types of resonant conditions.

The first five series capacitor banks installed by PG&E operated satisfactorily for a time without damping resistors. Subsynchronous resonant conditions have subsequently appeared at two of these banks, resistors were installed on two others during relocation or reconstruction, and one is still operating satisfactorily without damping resistors. It is significant that extensive tests made at the time of installation, including de-energizing and re-energizing the line at minimum load failed to disclose an incipient resonant condition.

Experience has also shown that the over-all X/R ratio of a feeder (including source, line constants, series capacitor and load) may eventually change from a stable combination to one which will sustain spontaneous oscillations. For these reasons damping resistors are

now included as standard components of all series capacitors and are installed during construction of the bank. Fig. 4 illustrates the method of mounting the damping resistors on the structure.

In a paper published in *Electrical Engineering*, August, 1937, Butler and Concordia showed that the size of damping resistor which will prevent sustained oscillations of a series capacitor depends on the circuit impedance, connected transformer kva, and rating of the capacitor itself. Values of resistance computed by the method outlined in their paper have been near 200 ohms so consistently as to suggest the use of a standard resistor with taps. A value of about 240 ohms per phase, although 10% to 25% greater than the computed optimum value, seems to be a good compromise which has moderate steady-state losses and which will usually provide adequate damping during circuit disturbances. Values of resistance as low as ten times the reactance of the series capacitor have been required where the particular combination of circuit constants was unusually prone to oscillate.

The damping resistors are specially designed for use with series capacitors and are not commercially available. The principal construction details are shown in Fig. 5. The original design (not shown, rated 2 kw) consisted of 120 ohms of No. 22 Nichrome V wire wound on a threaded transite water-pipe core. This design proved very satisfactory except when used on banks with relatively high impedance and load current where excessive core temperature caused cracking and spalling of the transite. The dissipation rating of the present design has been increased to five kw by changing to an open-type core of larger diameter.

Operating Experience Cited

PG&E's Cholame and Oakhurst banks have been selected for further discussion to illustrate typical conditions under which a series capacitor has proved to be the most economical means of providing required voltage improvement. The discussion of the Oakhurst bank also illustrates one of the operating problems occasionally encountered with series capacitors.

A. Cholame Series Capacitor

The Cholame series capacitor was installed in 1951 as a temporary means for increasing the voltage stability limit of a 12-kv feeder until a 70-kv transmission line and substation could be constructed the following year. This feeder was a heavily-loaded high-impedance circuit with a number of large irrigation pumps connected near the end of the line. Under certain conditions the starting of a large motor exceeded the voltage stability limit of the circuit, precipitating a spiral of rapidly increasing current and decreasing voltage supplied to the load. Complete collapse of the voltage was usually prevented by operation of the undervoltage trips on enough of the motors to enable the line voltage to recover and remain stable until restarting of the motors initiated the condition again.

The "before" and "after" voltage charts shown in Fig. 6 illustrate the condition just described and the voltage improvements obtained by installation of a 22.5-ohm series capacitor. No resonant condition or other operating difficulties were observed during the short time this bank was in service.

B. Oakhurst Series Capacitor

The Oakhurst series capacitor was installed in 1952 to reduce 12-kv voltage fluctuations caused by a 150-hp sawmill headrig. Tests on the primary feeder showed average dips of seven volts (120-volt base) with load fluctuations up to 600 kw and 340 kvar occurring at a rate of four per minute. Installation of a 21-ohm series capacitor reduced the average flicker from 7 to 1.5 volts and raised the steady voltage level by eight volts.

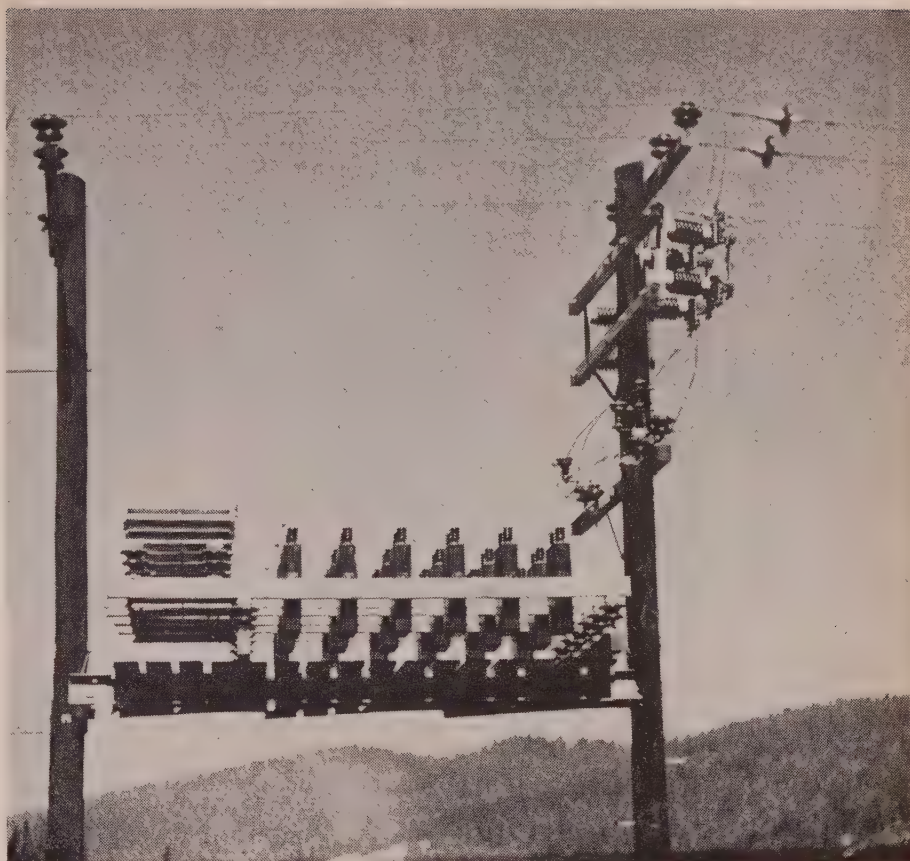


Fig. 4—Typical 12-kv series capacitor installation view showing the method of mounting over-voltage protectors and damping resistors on the structure.

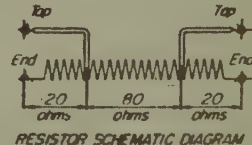
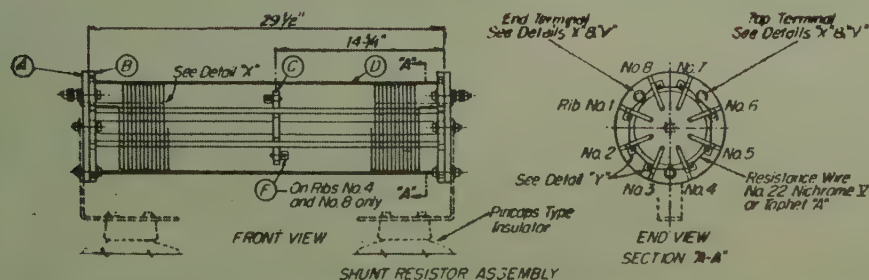
A basis for comparing costs of various alternate solutions can be obtained by assigning a value of 100% to the installed cost of the 21-ohm series capacitor. Replacement of 12.2 miles of No. 2 bare copper with 1/o copper or equivalent would have cost approximately 1200%. Total cost to extend 60-kw transmission and construct a 3-mva substation adjacent to the load would have been in excess of 5000%.

On several occasions, customers near the capacitor bank complained of high-voltage, rapidly flickering lights, and of motors running at

substantially less than normal speed. These indications of sub-synchronous resonance were only reported after the circuit had tripped out and reclosed automatically during minimum load period. Apparently the over-all X/R ratio of this circuit had reached a value which would sustain oscillations initiated by shock excitation but which would not cause spontaneous oscillations. In all except the last instance, which occurred on a Sunday morning, the oscillations were damped out as normal load built up on the circuit.

Fig. 7 is a reproduction of the

Fig. 5—Shunt-resistor assembly for series capacitor installation on 12-kv lines.



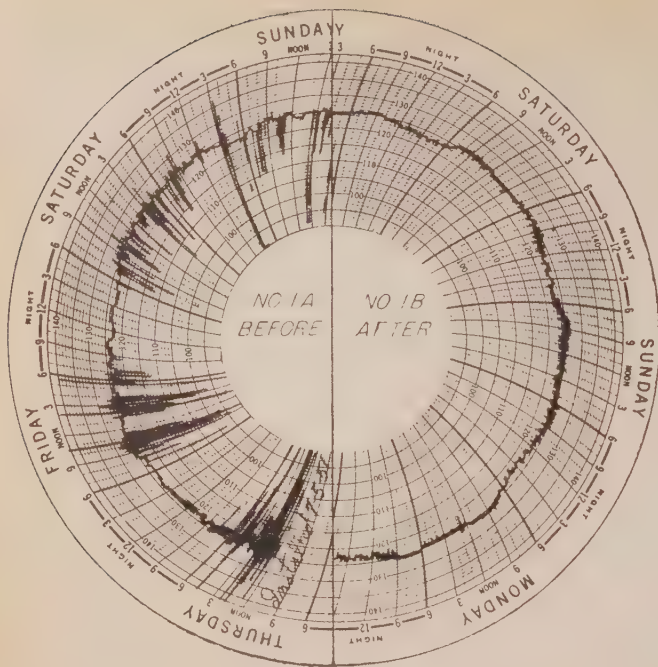


Fig. 6—Chart showing voltage condition on Cholame 12-kv feeder before and after installation of series capacitor.

chart from a recording voltmeter which chanced to be installed near the series capacitor at the time; it affords an interesting and unusual record of the resonant condition just described. It will be noted that the primary voltage increased from a steady value of 120 volts (120-volt base) at the time the circuit tripped out to 130 volts after the circuit was re-energized. The higher voltage represents the RMS value of the 60-cps fundamental voltage plus a subharmonic voltage component having a frequency and amplitude determined by the resonant circuit. The chart shows that

the circuit tripped out a second time and again returned to a resonant state which persisted until the capacitor was bypassed manually.

Damping resistors were installed immediately after the occurrence of the resonant condition just described. No recurrence of this condition has been noted since the resistors were installed.

Fig. 8 is a record of the occurrence of subsynchronous resonance at another series capacitor. This chart clearly shows a 5-cps subharmonic voltage superimposed on the 60-cps primary feeder voltage. The decaying oscillation near the

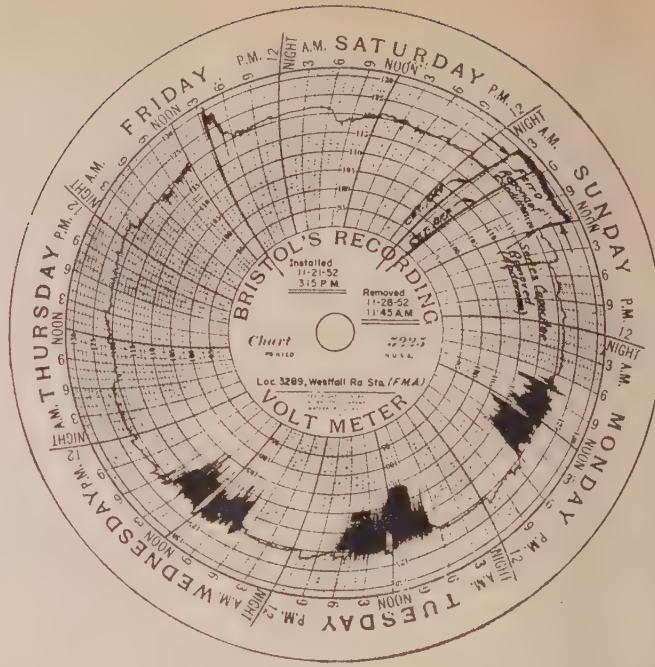


Fig. 7—Voltage chart showing ferro-resonant condition on Oakhurst 12-kv feeder.

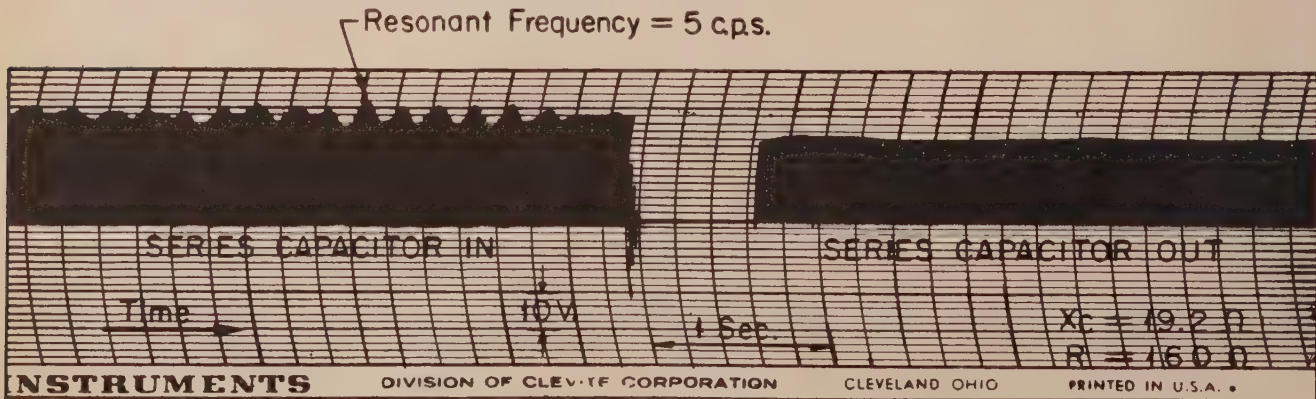
center of the chart is caused by a clipper circuit used to expand the voltage scale and is not related to the series capacitor.

Summary

Summarizing the performance of series capacitors over the past 11 years is not unlike taking a trial balance of an account. Although the total is well in the black, the account which records the performance of series capacitors is not without an occasional red figure.

A series capacitor correctly applied can be a very effective and
(Continued on page 89)

Fig. 8—Primary voltage chart showing resonant condition (Chart taken by Brush Recorder with clipper circuit).



Calibration: 2 V./mm.
Chart Speed: 25 mm./sec.

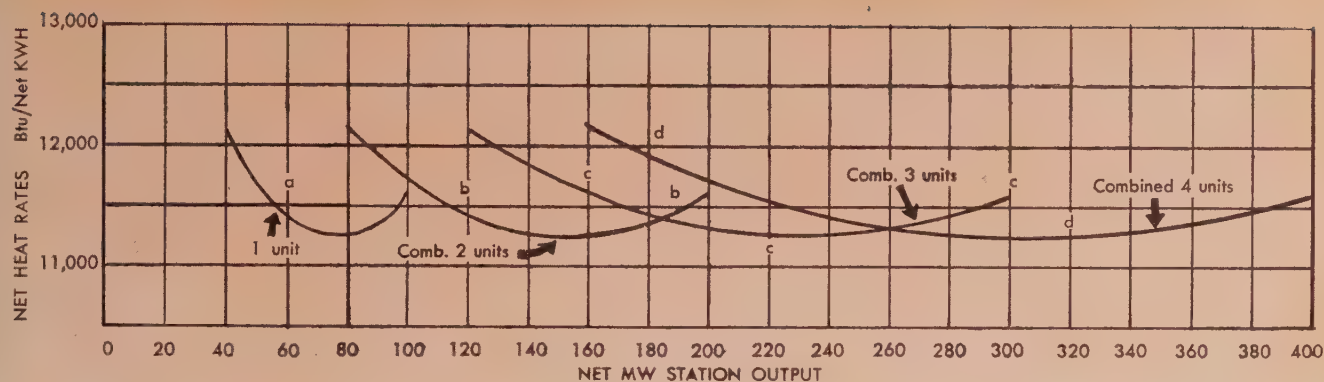


Fig. 1—Station Z containing four identical units; station heat rates with different totals of units running.

ECONOMIC COMBINATION OF UNITS FOR WEEKEND LOADS

By WILLIAM S. SCHMIDT,

Staff Consultant

*Power Generation Department,
Monongahela Power Company*

Scheduling the optimum combination of generating units for weekend load cycles can bring surprising rewards; load pattern is fairly uniform and period is long enough for practical application of economic scheduling.

UNLESS A COMPANY'S system load has grown so rapidly that all available generators must be run, there is usually a considerable excess of operable capacity during the weekend load cycle. Usually, the weekend load pattern is fairly uniform, and the period is long enough for practical application of an economic scheduling of units. In addition, the financial reward resulting from economic scheduling may be surprisingly large. Even a reduction in the area of one percent in total hourly cost of fuel and output maintenance on a system averaging 1100 mw per hour for the 53 hours of the weekend provides a saving of \$50,000 or more a year.

In discussing economics of adding or dropping units, we are dealing with total operating expenses, not incremental costs. The latter are used to divide load economically among units that are running.

A Time-Load Study

To illustrate that economics of weekend cycling is not just a simple problem of shutting down least efficient units as soon as load permits, let us examine a small self-contained system composed of one station having four identical units, net heat rate curves of which are shown in Fig. 1. These, incidentally, are not hypothetical but are based on published data. Since units are identical, each with its own boiler, the net heat rate curve for each unit is identical and is represented by curve "a" for one unit, curve "b"

for two units combined, curve "c" for the total of three units, and curve "d" for the station total of four combined units.

Assuming that the 370-mw station load has been decreasing to 280-mw, it is apparent that the load can now be carried by three units. Since all units have identical efficiency, it makes no difference which unit is shut down, but timing is the criterion. If one unit is removed from service at 290 mw, system heat rate will jump from 11,260 to 11,500, an increase of 70,000,000 Btu per hour for the station. At 30 cents/-million Btu, this increase in system heat rate adds \$21/hr to operating expense. Added to this increase in operating costs will be the cost of starting up the unit again.

From this example, it is apparent that it is uneconomical to shut down

Editor's Note: This is the essential text of a paper presented by the author at the October 1959 meeting of Edison Electric Institute's Electrical System and Equipment Committee.

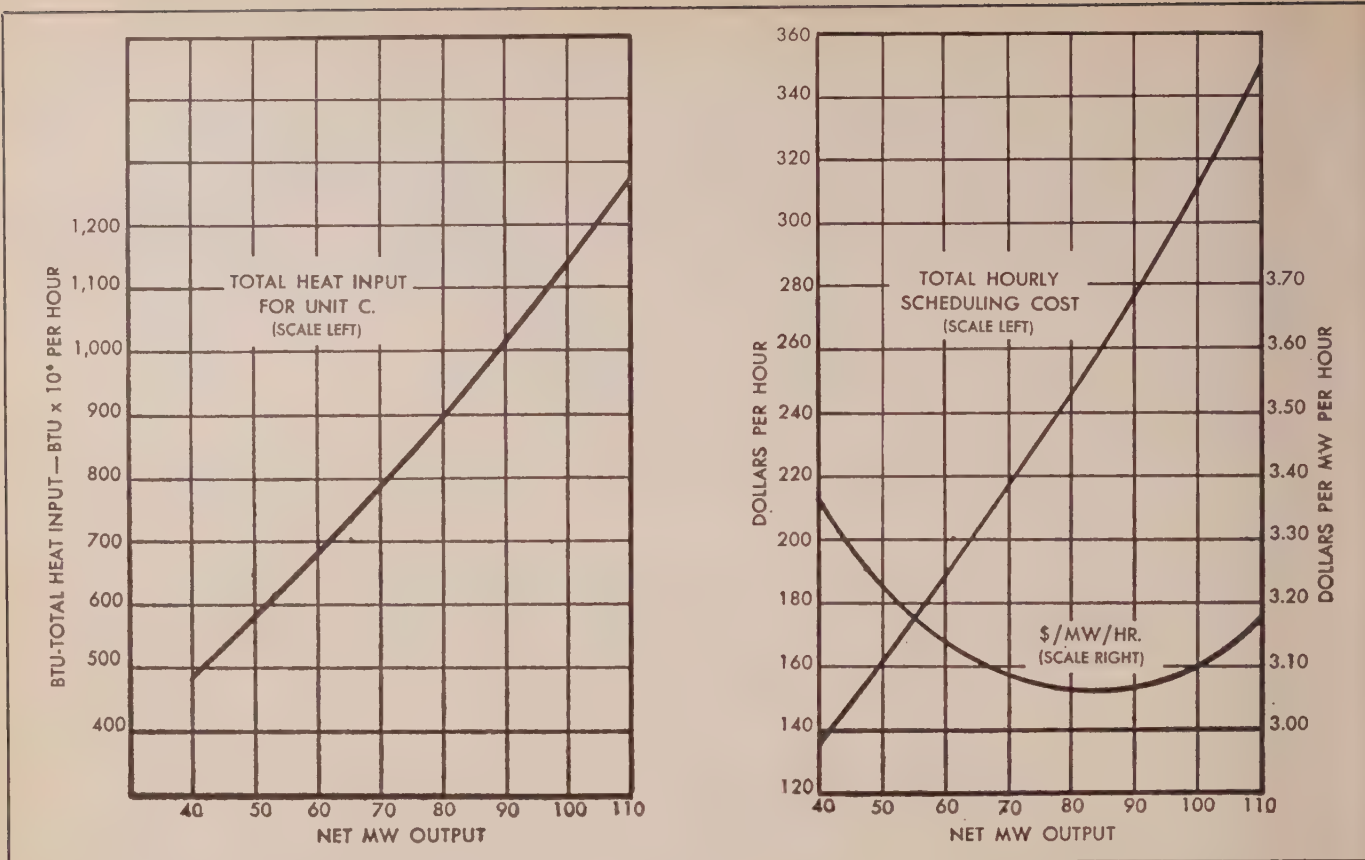


Fig. 2-a—Total heat input generating unit C.

Fig. 2-b—Hourly scheduling cost generating unit C.

a unit until the system heat rate curve for the three units is less than that for four units. This point on Fig. 1 is indicated at about 260 mw. However, load must remain under 260 mw a sufficient length of time to effect a savings from the shut-down unit which will be greater than the expense of starting it up again.

Thus, the problem becomes a rather complicated time-load study and, to add to the complexity, each generating unit in actual practice has a separate and distinct heat rate. As the number of generating units increases, particularly if the system has rather long transmission lines, the problem becomes very laborious to solve. What is needed for a study of weekend economic scheduling is a device that will quickly totalize operating costs of all units which are running to determine total system cost in dollars per hour for supplying varying system outputs for each hour of the weekend, and which then will totalize this for the entire 53 hours of the weekend period.

Steps Involved

Assuming that for weekend op-

eration there will be a sufficient excess of generating capacity to permit selection of units, the problem is to find which combination should be run to provide overall minimum operating cost for the system. Each combination of units will result in a different total weekend cost.

Since it is necessary to determine system hourly costs at various net outputs, it is fortunate that most of the basic data is already computed, as practically all companies are using incremental output or load-increased costs. To determine these incremental generating costs it is, of

course, necessary to have total heat input for various net mw outputs for each unit as shown in Fig. 2-a.

Total fuel input in dollars per hour is determined for each unit for various net outputs. To this cost is added the no-load spinning maintenance cost (a fixed cost) plus incremental output maintenance cost. Sum of these is "hourly scheduling cost" for each unit or group of units. This information is contained in Table I and is shown graphically in Fig. 2-b.

Other operating costs, such as labor, are not included in these costs, but must be considered separately if there is a change in cost of labor because of weekend shut-downs. Hourly scheduling costs considered here are included in basic data used by every company in determining incremental output costs with the exception of fixed no-load spinning costs, which are constant and do not affect incremental cost.

Computer Programming

For digital calculator programming, it may be necessary to set up these tables in greater detail, such as dollars per hour cost in steps of

TABLE I

Hourly Scheduling Costs of Unit C at Different Net Outputs		
NET OUTPUT MW	TOTAL COST \$/HR.	COST \$/MW/HR.
40	\$134	\$3.36
50	161	3.22
60	188	3.13
70	216	3.08
80	245	3.06
85	260	3.06
90	275	3.06
95	292	3.07
100	309	3.09
105	328	3.12
110	349	3.17

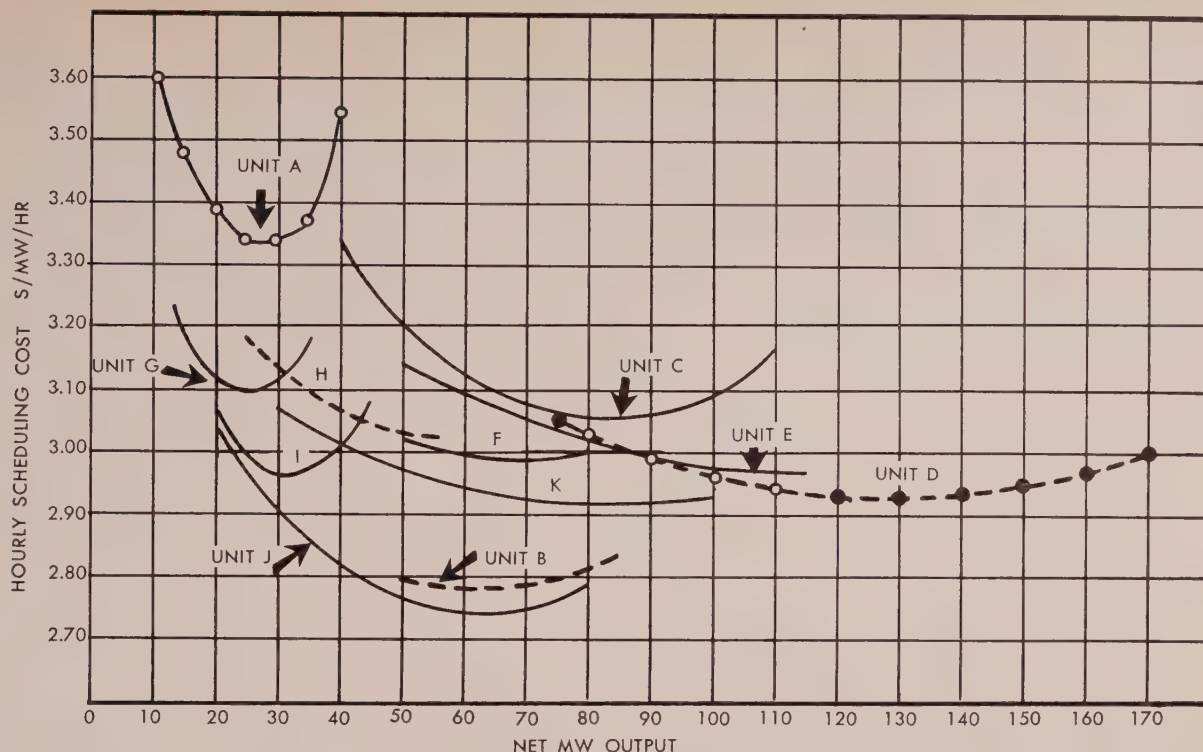


Fig. 3—Hourly scheduling costs of various individual generating units expressed in dollars per M per hour.

1-mw outputs. Hourly scheduling costs should also be determined on a \$/mw/hr basis for each generating unit or group, and these should be plotted on one large graph similar to Fig. 3 to assist system operators in determining approximate priority of scheduling units.

To determine economic weekend power supply, and to be able to take into account the effect of outages of various base load units, which are bound to occur, would require almost constant use of a digital calculator until a weekend economic dispatch pattern had been developed. To illustrate principles involved, we will assume that no unscheduled outages occur, that all equipment normally operated will be available and that the weekend load cycle will be approximated by using average hourly loads.

Comparison of two Load Cycles

The load cycle under discussion is shown in Fig. 4-a and as a duration curve 4-b. This cycle has a maximum hour of 1400 mw, a minimum of 900 mw, and over the 53 hours represents an output of 59,340 mwh. The duration curve can be approximated by the following average outputs:

Weekend Load Cycle I		
AVERAGE HOURLY LOAD—MW	NO. OF HOURS	MWH
1,400	1	1,400
1,300	15	19,500
1,200	4	4,800
1,100	8	8,800
1,000	24	24,000
900	1	900
		Total—59,400

In order to illustrate effect of different load cycles on system costs and priorities of units, we will assume a second weekend load cycle identical in shape to Cycle I, but with the load for each hour exactly 100 mw less. This Cycle II can be approximated as follows:

Weekend Load Cycle II		
AVERAGE HOURLY LOAD—MW	NO. OF HOURS	MWH
1,300	1	1,300
1,200	15	18,000
1,100	4	4,400
1,000	8	8,000
900	24	21,600
800	1	800
		Total—54,100

It is assumed that generators will, at all times, be loaded so that incremental output from each variable generating unit will be delivered to the system load center at the same cost. In this example, division

of system load among generators was actually performed according to this principle and total system hourly scheduling costs was the result of adding together costs of individual units.

Total system hourly scheduling costs for system outputs of Load Cycle I are summarized in Table III, with all units running with unit A alone out of service, and unit B alone out of service. By plotting these figures as a family of curves, Fig. 5, one is able to see more clearly how one combination of units is cheaper for certain system loads and more costly for other loads. These curves may be of some assistance to the system operator but their use is limited.

In order to determine total scheduling cost for the three combinations of generators for Weekend Load Cycle I it is necessary to tabulate hourly costs for the various outputs and multiply each cost by the hours' duration in the weekend. This is shown in Table IV, where it will be noted that the total hourly cost for the weekend is \$930 less with unit A alone shut down than with all units running. However, to take out unit A, a startup expense of \$130 is incurred when it is restored to service. Thus, total net

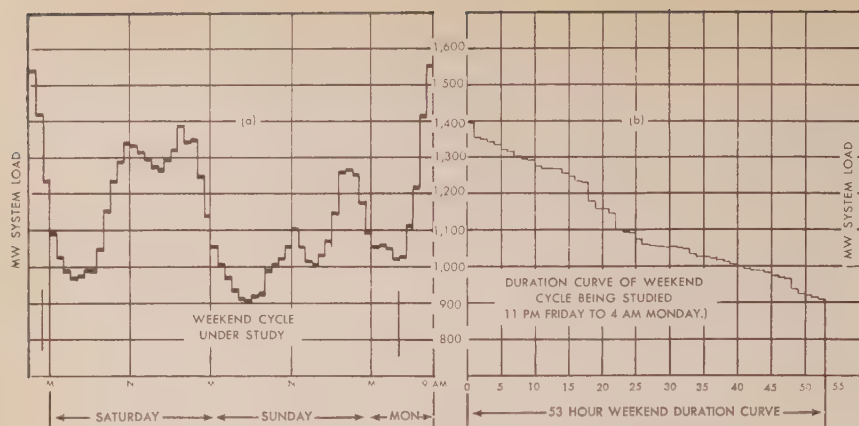


Fig. 4—Weekend cycle and duration curve of weekend cycle being studied (11 p.m. Friday to 4 a.m. Monday).

expense of Cycle I, with unit A removed is \$146,140.

When unit B alone is removed from service, total hourly scheduling cost is \$70 less than when A is removed, indicating that as far as system expense is concerned, that unit B should be shut down rather than A. However, startup cost of B is \$370, increasing net expense of Cycle I with B removed to a point where A has a removal priority over B by a margin of \$170.

Scheduling costs for Cycle II are shown in the right-hand column of Table IV. Priorities of Units A and B are reversed from those found in Cycle I. In spite of Unit B's high startup cost, it now has the wide margin of removal priority, over Unit A, of \$290; this is a change from Cycle I of \$460.

To find that removal of Unit B is more economical than removal of Unit A is quite surprising when one compares relative operating costs of the two units, as shown in Fig. 3. Based on these costs average cost of Unit A is about \$3.40/mw/hr while average for Unit B is about \$2.80/mw/hr.

More striking is the effect that change in load cycle has on costs of

various combinations of units. In Cycle I, when Unit B was removed, weekend expense declined from \$146,940 for all units running to \$146,310, a net decrease of \$630. However, in Cycle II, using the same comparison with Unit B removed, weekend expense declined from \$133,350, for all units running, to \$131,900, a net decrease of \$1,450.

This shows the unreliability of using priority lists for all conditions which were prepared for certain system operating conditions. With each change in system load cycles, either because of shifts in major loads or seasonal changes, the priority list should be recalculated until

a reliable pattern has been found. Loss or reduction of base load capacity for maintenance or because of auxiliary trouble may also upset priority lists. Since priorities for removal of units will largely be determined by the load-time cycle, the more the actual load differs from the forecast the greater will be the operating expense above optimum. It should be pointed out that the example used did not determine the number-one priority shutdown position of all generating units, but illustrates the shift in priority between two individual units because of the change in the weekend load cycle.

Other Benefits

Being able to obtain total system scheduling costs for various load cycles with or without a particular unit is also a tool for determining the value of the unit to the system for different load cycles. Further, it enables management to determine cost to the system of running units for area protection.

With procedures outlined, cost to the system of spinning reserve capacity for different load cycles is easily determined. For example, the amount that total system operating

TABLE II

Hourly Scheduling Costs of Unit C
For Various System Outputs and
Different Combinations of Units

SYSTEM LOAD MW	ALL UNITS RUNNING		UNIT A OUT		UNIT B OUT	
	UNIT C NET OUTPUT MW	\$/HR.	UNIT C NET OUTPUT MW	\$/HR.	UNIT C NET OUTPUT MW	\$/HR.
1400	99	\$305	100	\$309	105	\$312
1300	95	292	96	295	97	298
1200	80	245	83	254	89	272
1100	60	188	62	193	70	216
1000	45	148	46	150	50	161
900	40	134	40	134	42	140
800	40	134	40	134	40	134

TABLE III

Total Hourly Scheduling Costs for Various System Outputs
and Three Combinations of Generating Units

SYSTEM OUTPUTS MW	WITH ALL UNITS RUNNING		WITH UNIT A (ALONE) OUT OF SERVICE		WITH UNIT B (ALONE) OUT OF SERVICE	
	TOTAL COST	\$/MW/HR.	TOTAL COST	\$/MW/HR.	TOTAL COST	\$/MW/HR.
1400	\$3,584	\$2.560	\$3,612	\$2.580	\$3,633	\$2.592
1300	3,259	2.507	3,263	2.510	3,282	2.525
1200	2,964	2.470	2,952	2.460	2,964	2.470
1100	2,700	2.455	2,673	2.430	2,670	2.427
1000	2,450	2.450	2,420	2.420	2,404	2.404
900	2,218	2.465	2,187	2.430	2,164	2.405
800	2,000	2.500	1,976	2.470	1,944	2.430

expense decreases when a unit is removed from service is, in effect, cost to the system for the mw spinning reserve represented by that unit. When Unit A, 40 mw, was removed from service in Cycle I, there was a decrease of \$800 in operating expenses; hence the cost of spinning 40 mw was \$800/40 or \$20/mw for the weekend.

In the case of Cycle II, the same operation reduced operations \$1160 or \$29/mw spinning for the weekend. Of course, if system expense should increase when the unit is removed, there will be a negative cost to the system for that amount of spinning reserve.

Financial rewards in attaining economic scheduling seem very much worthwhile. Deviation from the optimum schedule, it has been shown, may result in a penalty of many thousands of dollars per week. Now that more companies have at their disposal digital computers and economic dispatching

equipment, it is expected that operating experience in economic dispatching may soon be made available to the industry.

References:

1. "Economy Loading of Power Plants and Electric Systems," Steinberg and Smith. John

Wiley and Sons, Inc., N. Y., N. Y., 1943.

2. "A Study of the Economic Shutdown of Generating Units in Daily Dispatch," C. J. Baldwin, K. M. Dale and R. F. Dittrich. AIEE Transactions Paper No. 59-850.

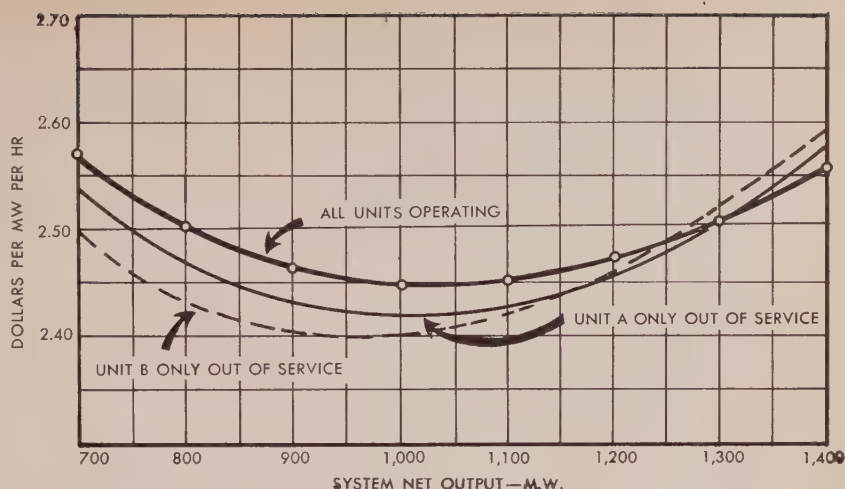


Fig. 5—System hourly scheduling costs for three combinations of generators, expressed in dollars per MW per hour.

TABLE IV—Comparison of System Weekend Scheduling Expense for Three Different Combinations of Generating Units and Two Different System Load Cycles

	SYSTEM OUTPUT MW	TOTAL SYSTEM SCHEDULING COSTS \$/HR.	SCHEDULING EXPENSE PER WEEKEND					
			LOAD CYCLE I			LOAD CYCLE II		
			HOURS DURATION	1,400 MW PEAK 900 MW MIN. 59,400 MWH \$ PER WEEKEND		HOURS DURATION	1,300 MW PEAK 800 MW MIN. 54,100 MWH \$ PER WEEKEND	
All Units Running	1400	\$3,584	×	1	=	\$ 3,580	—	—
	1300	3,259	×	15	=	48,880	×	1 = \$ 3,260
	1200	2,964	×	4	=	11,860	×	15 = 44,460
	1100	2,700	×	8	=	21,600	×	4 = 10,800
	1000	2,450	×	24	=	58,800	×	8 = 19,600
	900	2,218	×	1	=	2,220	×	24 = 53,230
	800	2,000	—	—		×	1 = 2,000	
Total Weekend Scheduling Expense					\$146,940			\$133,350
Unit A (alone) Shutdown	1400	\$3,612	×	1	=	\$ 3,610	—	—
	1300	3,263	×	15	=	48,940	×	1 = \$ 3,260
	1200	2,952	×	4	=	11,810	×	15 = 44,280
	1100	2,673	×	8	=	21,380	×	4 = 10,690
	1000	2,420	×	24	=	58,080	×	8 = 19,360
	900	2,187	×	1	=	2,190	×	24 = 52,490
	800	1,976	—	—		×	1 = 1,980	
Total Hourly Costs					\$146,010			\$132,060
Startup Expense Unit A					130			130
Total Weekend Scheduling Expense					\$146,140			\$132,190
Unit B (alone) Shutdown	1400	\$3,633	×	1	=	\$ 3,630	—	—
	1300	3,282	×	15	=	49,230	×	1 = \$ 3,280
	1200	2,964	×	4	=	11,860	×	15 = 44,460
	1100	2,670	×	8	=	21,360	×	4 = 10,680
	1000	2,404	×	24	=	57,700	×	8 = 19,230
	900	2,164	×	1	=	2,160	×	24 = 51,940
	800	1,944	—	—		×	1 = 1,940	
Total Hourly Costs					\$145,940			\$131,530
Startup Expense Unit B					370			370
Total Weekend Scheduling Expense					\$146,310			\$131,900



While utility crews are familiar with company circuits and voltages, contractor linemen, particularly during emergency conditions, may have to deal with lines and construction details completely new to them. In such situations, pre-planning for safety is especially essential.

CONTRACTOR ALSO HAS SAFETY OBLIGATIONS

By W. T. ROGERS,
Safety Director
Ebasco Services Incorporated

Utility management should be interested in contractor's safety records as well as performance records; a poor record is reflected in contract price and, frequently, a contractor-accident is a public-relations setback for the utility.

UTILITIES HAVE ALWAYS most willingly accepted safety responsibility of both their employees and the public. Management policy on this subject is quite clear and often it is spelled out in a prominent place in the safety and operating manual. As a result of this emphasis the electric utility worker is twice as safe as he used to be and the mortality rate has declined as much as 75 percent. Mindful of its own impressive record in improving safety, utility management is equally concerned with safety accomplishments of the contractor engaged to construct and maintain its lines. This concern is quite realistic and it involves both economic and moral values.

In line construction and maintenance, often handled by contractors, where does responsibility for well-being of workers lie? Obviously, the answer must be, on all levels, and safety must have the full support of top management. But, safety cannot be stressed by the utility and ignored by the workers. And more than lip service must be given to the safety problem by the contracting firm for whom the line employee works.

Positive safety measures are a "must" for utility, contractor and worker alike.

The Worker

Prime responsibility for safety lies with the worker himself. He owes it to himself and his family to steer clear of unsafe practices. But, human nature being what it is, he will often take a short cut that could very well cause grave damage. And, let's face it, an unsafe worker is a hazard to more than just himself. His carelessness or lack of consideration may cause death or serious injury of others.

In years gone by, the power line worker was considered a sport, the "cowboy" of the industrial world. He took pride in his trade and even in the fact that it was a dangerous one. His was not a job for youngsters or weaklings, and he was apt to emphasize his superiority by "grandstanding" — by disregarding at times some of the precautions a more sensible man would take. Today the lineman is just as much an individualist but he has a different outlook. A large part of this difference is reflected in his greater concern for safe work practices.

The Contractor

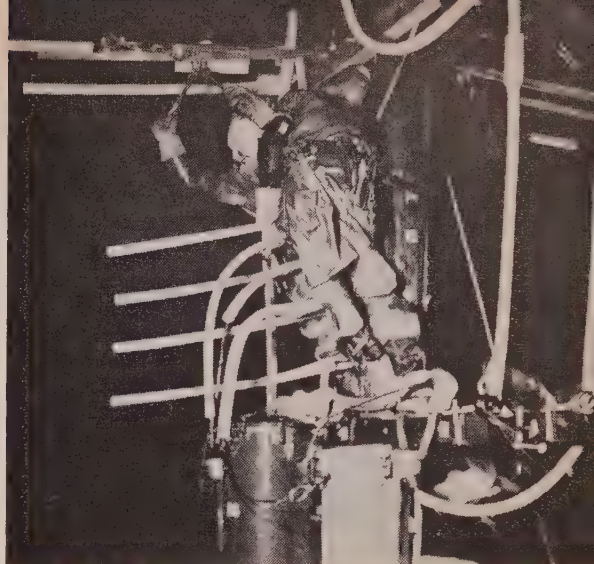
Safety cannot be a hit or miss proposition; it must be planned and executed with all the thoroughness and ingenuity that goes into construction of a new building. The contractor is the foundation upon which a sound safety program must be built. The program should be tailored to cope with the hazards of the particular job. It should include indoctrination and training of new employees. It should include educational materials and techniques that will teach the employee the value of safe performance to the utility, the contractor and to himself. Above all, the contractor must see to it that the program is effectively supervised, for all the safety theories and techniques in the world are useless unless the program has the benefit of close supervision.

No crew is composed entirely of perfect workers. Contractor's supervisor must learn rapidly, as new men are hired, how far he can go in trusting each man to do good work and to work safely. Beyond the point to which each man can be trusted, the contractor must fur-



Even in emergencies and bad weather, linemen must take time to "rubber up" and use all necessary personal protective equipment.

Contractor accidents involving the public are harmful to the utility's public relations; barricades and warning signs should be used to keep the public out of the danger area.



ish the instruction, supervision and discipline to supplement the weakness of each worker and bring him up to a generally high average of safety and reliability. When a man does not respond to instruction, when he requires too much supervision, and when reasonable discipline does not impress him, a serious problem exists and prompt action is necessary.

Supervision

The task of closely supervising a crew when its members are strung out over several sections, or when some of them are changing over lines in an alley while others are setting poles in the street, is not an easy one. But, the contractor has no alternative. He must organize and arrange matters so that his crews receive adequate supervision. While a supervisor cannot be everywhere at once, there are some very good alternatives for his personal watchfulness. The constructive help of a safety consultant will be of assistance in recognizing these alternatives and establishing a program for their development and application.

Although the safety value of personal protective devices, like rubber gloves, sleeves, blankets, line hose, goggles and head protection, has long been recognized by both management and workmen of utilities, some men still shy away from using them. Some contractors may have to be convinced of the value and economy of supplying personal safety equipment in full measure. It is equally vital that workmen employed by contractors be keenly aware of the hazards of their jobs. No man has learned his

trade as a lineman until he has acquired the habit of wearing rubber gloves and using other safety devices unfailingly whenever he is working on or near electrical conductors or apparatus.

Linemen assigned to rebuilding or maintenance jobs are exposed to another danger which is just about as hazardous as working on hot wires—working on old poles. The man who bets his life on the soundness of an old pole is taking an unnecessary chance. Soil conditions may cause rot well below the ground line so that even a probing bar does not always provide a reliable test. Liberal use of guys and braces is the best life insurance.

Utility's Interest

Other than obvious concern for the welfare of the worker, there are several reasons why a utility should have continuing interest in the contractor's work methods and safety activities. Accidents on a utility's property are almost invariably charged to the utility no matter who is injured or why. Sel-

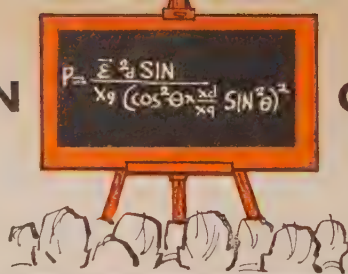
dom does the press or newscast point out that the injured man worked for a contractor—not the utility. The utility's customers are not even aware that a contractor is involved; the simple fact that a man on a utility pole is hurt is usually sufficient evidence to place the accident at the doorstep of the utility. That situation can create a serious public relations problem, depending on frequency and seriousness of such incidents.

The utility is also interested in the contractor's safety performance for economic reasons. Cost of the contractor's premium for workmen's compensation, public liability and other insurance is obviously included in the contract price a utility pays.

For moral, public relations and economic reasons, utility management is interested in a contractor's safety experience as well as in his performance record. For the same reasons, it is to the contractor's advantage to be equally concerned with the effectiveness of his own safety program.



Frequent practice in safety methods is necessary to maintain high degree of proficiency.



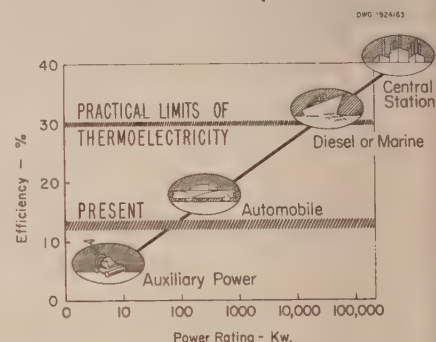
Advanced Utility Methods Explored At PEA Planning Meeting

Impact of fuel cells on the electric-power industry within the next five years will be small, said Dr. Herman A. Liebhafsky, General Electric Research Laboratory, in addressing the System Planning committee of the Pennsylvania Electric Association during its winter meeting February 15-16 in Pittsburgh. Neither, he continued, do fuel cells producing chemicals and by-product electricity seem important as potential sources of electricity. A minimum fuel cost for a central-station fuel cell has been estimated as required to be one mill but considerable research will be required to achieve this. Time required for such research will depend largely on size of the research effort.

tion is a simple and competitively efficient way to provide power for a number of small and intermediate loads. Efficiency of a thermoelectric plant, he continued, although not competitive with modern central power stations, may soon be sufficiently high to establish it as a useful peaking complement to a central power station.

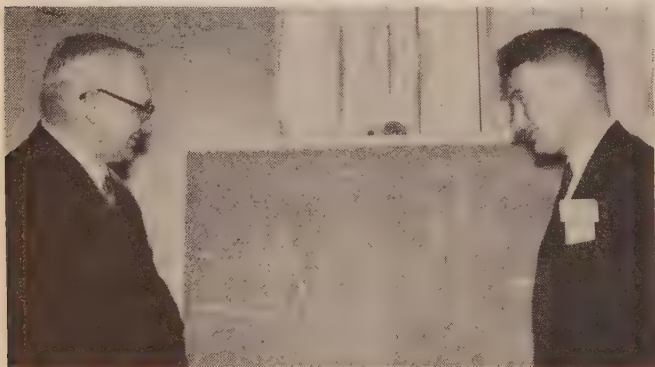
On the basis of capital cost, said Dr. Sommers, there is an excellent possibility that, in the absence of moving parts, thermoelectric generators can be built at a lower cost than their conventional counterparts. Many short-time or intermittent operations such as peaking or emergency generation conditions dictate that capital cost will be the

Efficiencies and power ratings of common power producers were compared by Dr. Somers, Westinghouse Research Laboratory, as shown here with present and practical limits of thermo-electrical power units.



predominant factor rather than heat rate.

Pennsylvania Electric Company is building an experimental 460-kv transmission line near Johnstown that promises to be the first three-phase line operating at full voltage and carrying power as part of an established power grid, said I. L. Phillips, of that company. It is expected that the line will be energized in the summer of 1960. Design, construction, and much of the testing of the line will be under the direction of Penelec engineers, he said. The line is some 13 miles long and will parallel an existing 115-kv double-circuit steel-tower line between Claysburg substation and Saxton generating station which is



Drs. H. A. Liebhafsky, General Electric Company, and E. V. Somers, Westinghouse Electric Company, left to right, both discussed methods of direct conversion of heat to electricity before the PEA group.

There is no mystery about the fuel cell, continued Dr. Liebhafsky. Its success depends in the first instance upon increasing the rates of desirable electrode reactions. It is hoped that such reactions will be well enough understood in the future so that fuel-cell progress can be made in less empirical ways than we are now forced to use, he concluded.

Still another method of direct conversion of heat into electric power was evaluated by Dr. Edward V. Sommers, Westinghouse Research Laboratories, who stated that thermoelectric power genera-

C. Morrison, chairman, PEA System Planning Committee, left, discusses program with; left to right, W. Baum, vice-chairman; W. H. Prinkey, who reported on service continuity; and F. M. Reed, chairman of the service-continuity subcommittee.



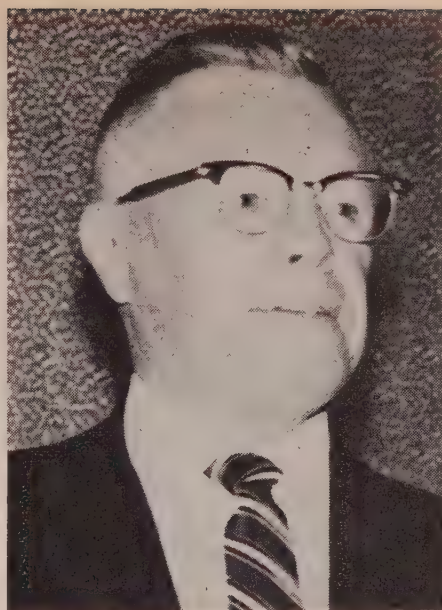
also location of the General Public Utilities nuclear power plant which is already in the stages of construction.

Original plans to construct a line of all wood-pole structures have been modified, continued Phillips, to incorporate trial and comparison of other structures such as full steel towers, guyed metal-pole structures, and laminated wood structures. The line will be constructed in four parts using different-sized conductors in order to compare corona effects. Section A will consist of twin-bundled expanded ACSR conductors of 1.75 in. in diameter, spaced 16 in. Section B will consist of twin-bundled expanded ACSR conductor 1.6 in. in diameter, spaced 16 in. Section C will consist of twin-bundled expanded ACSR 1.4 in. in diameter, and the remaining section will use a single conductor of specially designed 2.32-in. diameter ACSR conductor.

A special three-phase 50-mva transformer will be provided by General Electric Company for termination of one end of the line while the other end of the line will utilize three specially-built single-phase 20-mva transformers provided by Pennsylvania Transformer Company. The General Electric Company has volunteered to conduct the entire program pertaining to study of lightning in vicinity of the line and of switching surges. Study of corona and of RI values will be done by Penelec engineers, Mr. Phillips stated.

Increasing Load Helps Keep Rates Down

Increases in load have played a major part in making it possible for electric utilities to hold the line on rates and even to decrease them since 1937 said W. Lyman, vice-president, Duquesne Light Company, during a luncheon talk. If it had not been for increases in load during this period, in all probability it would have been necessary to have increased rates by 100 percent because of inflation in prices and costs, he said. Mr. Lyman pointed out that although costs of construction, wages, and fuel have all gone up considerably since 1937, increased density of load has brought unit cost per kwh of total sales



W. J. Lyman, vice-president, Duquesne Light Company, addressed the Planning Committee during a luncheon.

down 25 percent, offsetting these increases. We need solutions for the next 20 years as effective as these have been over the last 20 years, he challenged.

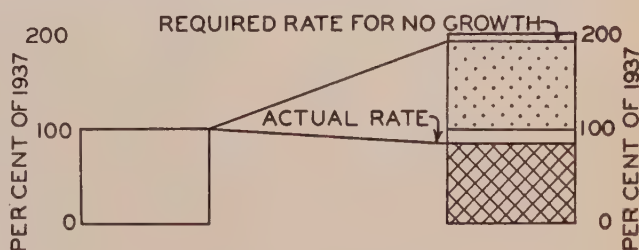
Complete self-regulation of the system voltage so that voltage gradients from generator to primary circuit will be little greater at heavy load than at light load was declared a possibility by F. M. Reed, General Public Utilities System. This could be done through use of fixed and switched capacitors alone with no

need for voltage regulators or TCUL equipment, he said, so long as generator voltages were swung a bit to assist. Such a system would result in a major saving in capital expenditures which would be enhanced because capacitors could be added in small increments to match the load, whereas regulators must be added in sizes that would require comparatively large initial investment.

Use of fixed taps on step-down transformers in distribution substations might call for no fixed capacitors in such a scheme, he continued, so that full var load could be carried by the generators at light load when capacity is usually available and during which period line I²X losses are very cheap. This pattern would keep the light-load voltage as low as possible and thus allow a maximum boost to be provided by fixed taps at the substation and distribution transformers. Then, as load increased and capacitors came on the system and generator voltages were raised, net effect would be to cancel out much of the voltage drop throughout the system and on the feeders. Capacitors on the feeders themselves, he said, are more effective in such a scheme than the same var generation in substations since their effect

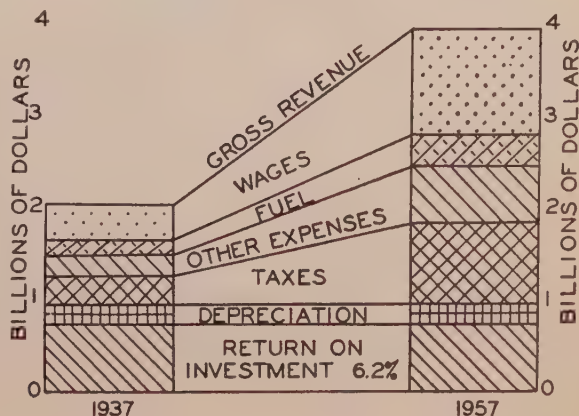
(Continued on page 89)

AVERAGE RATE PER KWH OF TOTAL SALES



Increase in electric-utility load density, according to W. Lyman, vice-president, Duquesne Light Company, has been a major factor in keeping rates in line notwithstanding inflationary increases in utility costs as shown here.

REVENUE AND EXPENSE



Cresap Urges Tax Reduction For Basic Research

To encourage greater support for basic research to meet the challenge of the Soviet Union, Mark W. Cresap, Jr., president of Westinghouse Electric Corp. has urged a change in the tax laws to provide an incentive to American industry.

Speaking before the Economic Club of Detroit, Mr. Cresap pointed out that simply exhorting industry to boost its support of basic science will not do the job, since basic research is not industry's first responsibility and it will do no more than it can justify economically.

Mr. Cresap said that government already pays for almost 50 percent of the total national basic research effort and that additional basic research must come primarily from funds supplied by American industry, either as contributions to universities and research centers or to support basic research in industry's own laboratories.

"There are strong arguments against calling on government to pay a still higher percentage of the bill for pure research.

"If additional support for basic research does not come from government, then there is only one other place it *can* come from. That is American industry.

"The answer is that the federal government must give industry a reason—an incentive—to increase progressively its support of basic research."

Suggested incentives, to date, have included faster write-off of new research facilities, outright tax credits for research contributions or expenditures, and income tax write-offs for expenditures on scientific research facilities, he said.

He pointed out that the Curtis Bill (HR 4797) now before Congress would allow a business or individual taxpayer to take an income tax credit for contributions or expenditures to basic research work.



To provide adequate power following the severe drought of June 1959, Brazilian subsidiary of American and Foreign Power Co., Inc., Cia. Força E Luz De Minas Gerais, installed 11,000 kw of capacity by moving in 11 1000-kw Electro-Motive Mobile Generator units. The Brazilian company was formerly served by hydro plants. After water supplies return to normal, the 11 units will be used for peaking and emergency service.

Single-Purpose Computer Control To Gain More Acceptance

American industry's increasing acceptance of automatic electronic computer control markedly underscores three trends that will be effected in this development over the next five years, according to a Daystrom, Incorporated executive.

Vice president and general manager of the firm's Control Systems Division of La Jolla, California, Chalmer E. Jones, forecast:

1. The next two or three years will see an upswing in the use of smaller, less expensive single-purpose computer control systems. Many firms will be able to equip themselves with single-purpose computer control systems for \$30,000 to \$40,000 as against the \$300,000 required for a general purpose instrument.

2. In the period three to five years hence great attention will be given to improving analytical instruments and to new transducers. Work on the analytical instruments

will be designed to lessen the importance of human judgment in handling information gleaned and processed by the system. New transducers will be created to give a more accurate representation of the phenomena being monitored.

3. Design of factory processing equipment itself will be based increasingly on computer control, which, in turn, will enable industry to turn out many products heretofore impossible of production because of the speed required in processing.

Mr. Jones, a pioneer in the computer control field, said that many firms no longer justified their investment in a system on economic grounds alone, because experience had demonstrated other considerations that made computer control a good thing. He said they had found computer control and operation of their plants improved the quality of their product, stepped up production and enabled their plants actually to produce at the rate for which they were built.

Aluminum Transmission "Pole" Surpasses NEMA Standards 12%; Promises Savings

A high-strength aluminum-alloy lattice pole transmission structure fabricated by the Handley-Brown Co. of Jackson, Michigan, has passed static loading tests simulating wind loadings to 140 mph, 12-percent greater than NEMA standards. Specially designed for use in congested residential and commercial areas on the system of the Louisiana Power and Light Co., the poles for the first time are in a favorable competitive situation price-wise with steel structures.

The pole, standing 85 ft long and with a base of only two ft square, is intended for use on a 110-kv transmission line, with spans of 600 ft.

Simulate Hurricane Winds

Four separate tests were conducted to illustrate the high strength of the lattice pole while supporting three 1.28-in. diameter ACSR conductors and a $\frac{3}{8}$ -in. static wire. These tests simulated wind strengths of 80, 110, 125 and 140 mph.

The lattice pole was cantilever mounted to a support. Weights totalling 6345 lbs were suspended from the cross arms and other strategic points along the pole to represent wind loads on the pole and

conductors. Simultaneously, longitudinal test loads of 5485 lbs were applied through dynamometers to represent the dead weight of the pole and conductors.

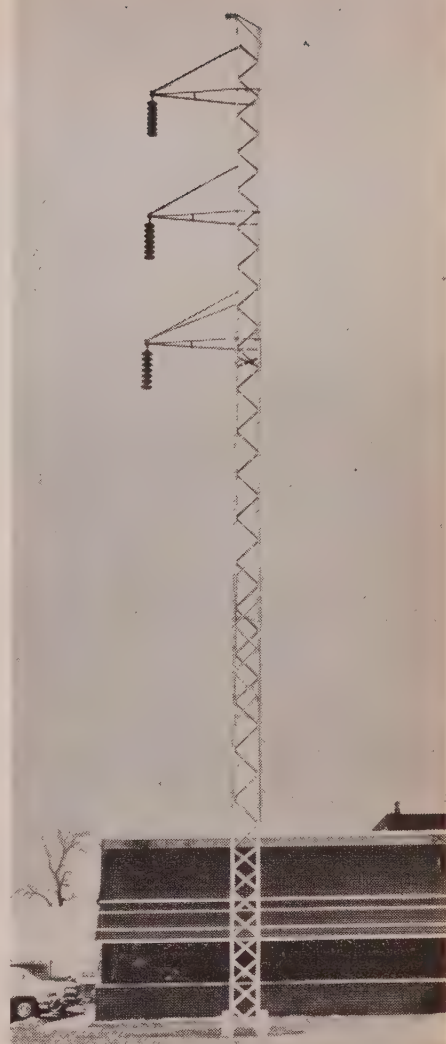
Under loads equivalent to 140 mph, the greatest net deflection was 84 in. from the horizontal without failure to any part of the structure. Permanent deflection, after load was removed, was virtually nonexistent. (See table page 75.)

According to a Handley-Brown spokesman, the poles will be competitive with steel structures on an initial cost basis. Bonus savings come from speed and ease of erection and long maintenance-free life.

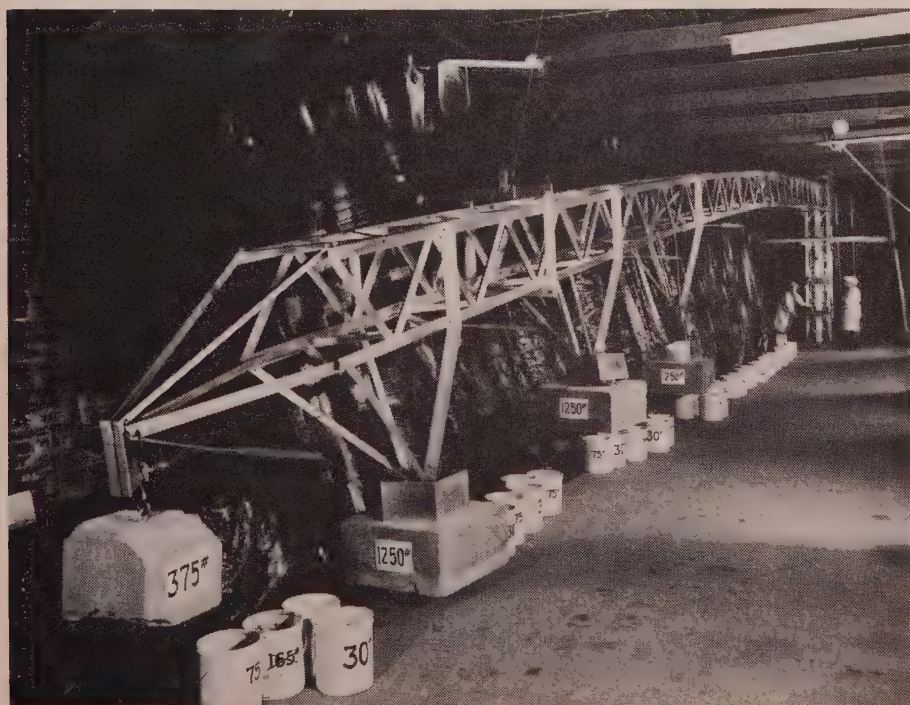
Totally Welded Construction

The pole is welded throughout its entire length, including all chord angles and lacing, eliminating the slippage which occurs with bolted construction, in standard aluminum and steel tower structures. The only field bolting required during erection of the one-piece lattice pole is to connect the crossarms to the pole and the pole to the concrete foundation.

The pole itself, with three 7-ft crossarms, weighs 1400 pounds or about 20-percent the weight of an



Erected lattice pole outside Handley-Brown plant. Note tapered appearance created by use of three different sizes of chord angles in the main structural members.



Pole under NEMA Standards loading. Equivalent to wind of 125 mph, the loading produced net deflection of 67½ in. Under 140 mph equivalent loading, net deflection was 84 in. Permanent deflection after load was removed was negligible.

equivalent steel pole. To eliminate excess weight, Handley-Brown engineers designed special extrusion shapes for the main structural members instead of merely substituting aluminum for steel in standard tower construction.

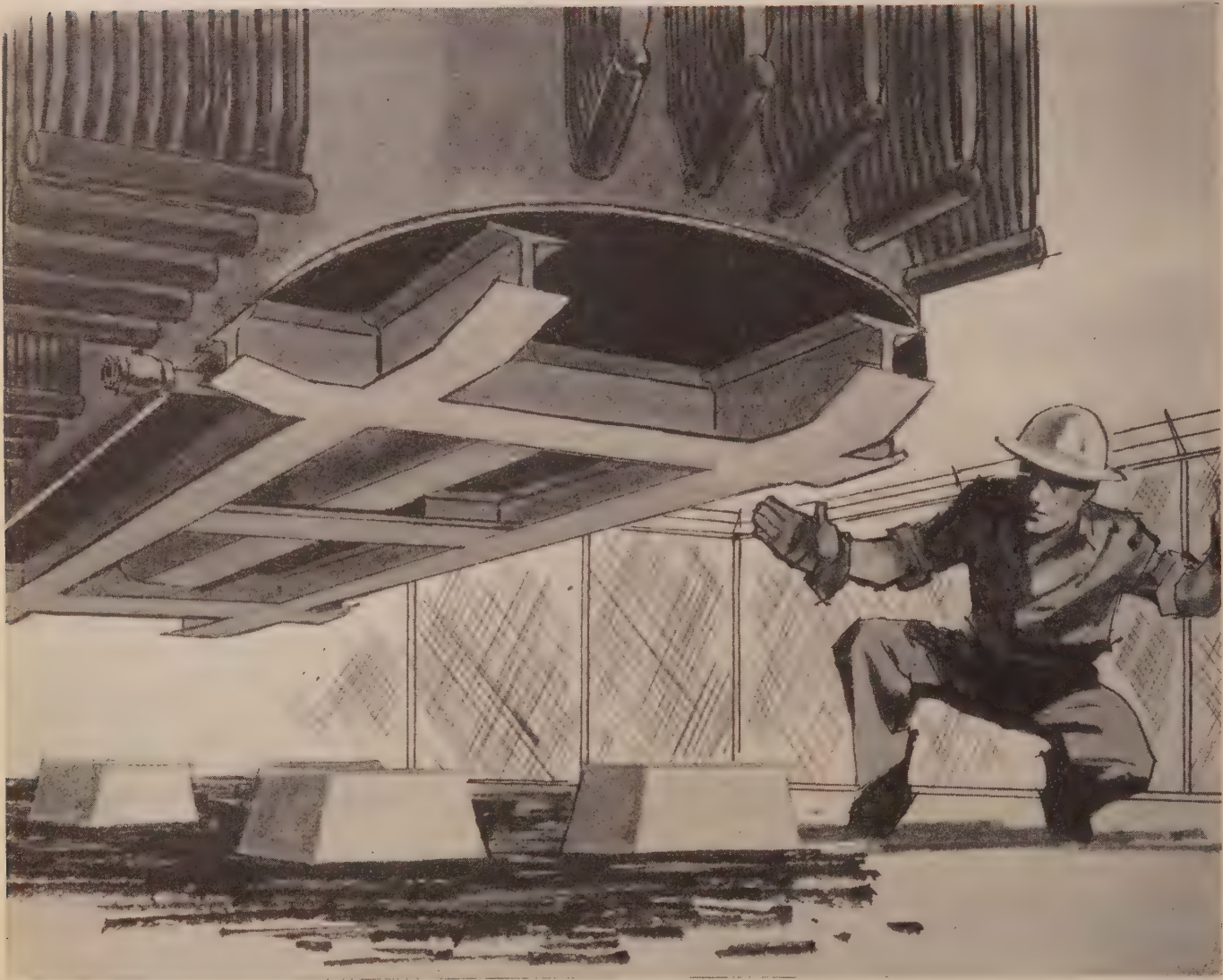
Although the pole does not taper from bottom to top, the weight and strength is strategically distributed by using three sizes of chord angles with stiffener plates welded inside the chords.

These specially designed extruded chord angles employ a bulb at the edge which performs four functions:

1. Strengthens the edge where failure usually occurs in conventionally designed shapes.
2. Provides a longitudinal groove on the chord angle edge into which the lacings fit and are

(Continued on page 75)

ALLIS-CHALMERS



Installs for less on pier, plank or pad

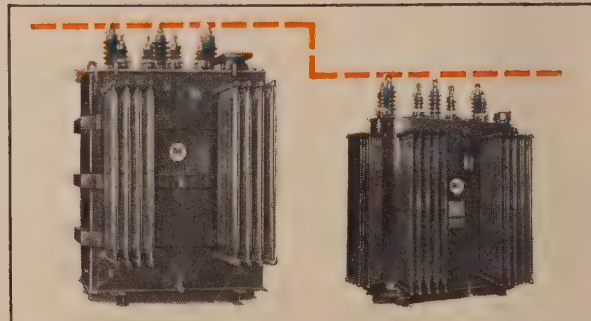
New Allis-Chalmers small power transformers are lighter, lower by 30%

Installation charges slashed! That's the start of the story for these new-design A-C power transformers. Their "hide-away" compactness and lighter weight add up to big savings in handling and pad costs. (The 34.5-kv, 3750-kva transformer, for example, weighs 8000 lb less than its predecessor.)

New design reduces losses, exciting current and noise level. Instruments are grouped for operator convenience. Servicing ease is assured by such features as a base sump, which collects and removes contaminants from active oil, and the built-in drain which permits sampling at the very bottom.

Get the complete story from your nearby Allis-Chalmers office or write **Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin**

A-1238



New low-profile transformer features include a self-resetting mechanical relief device that automatically resets and reseals after operation . . . and simplified handhole covers with 5 cap tive "J" bolts instead of 14 nuts to remove for entrance.

(Continued from page 71)

welded, speeding up production and keeping costs down.

3. Makes possible a single weld which gives the advantages of both butt- and lap-welds.
4. Acts to carry off heat of the welding process before it can affect the weld area, thus providing greater weld strength.

The design is an outgrowth of joint efforts between engineers of the Louisiana Power and Light Co., Line Material Industries (who will distribute the new poles), and the Handley-Brown Co. Olin Mathieson Chemical Corp. was the supplier of the 6061-T6 alloy.

DEFLECTION

(Expressed in inches under cantilever tests)

NO LOAD	LOAD EQUIVALENT IN M.P.H.	UNDER LOAD	NET DEFLEC- TION
54¾	80	83½	28¾
55	110	109½	54½
55	125*	122½	67½
56¼	140	135¾	84

*NEMA Standards

Testing of the pole was conducted before a group of over 40 utility and construction engineers at the Handley-Brown plant.

A-C Backlog Up

Allis Chalmers Manufacturing Co. has announced that backlogs of orders for electrical and industry apparatus amounted to \$245.2 million on December 31. This is an increase of more than 26 percent over the backlog a year previous.

DON'T READ THIS AD

if you don't want to get ahead.

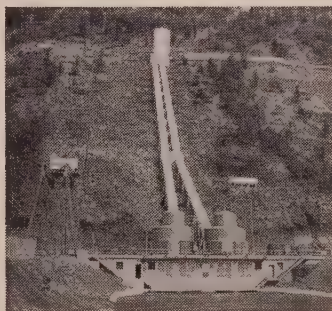
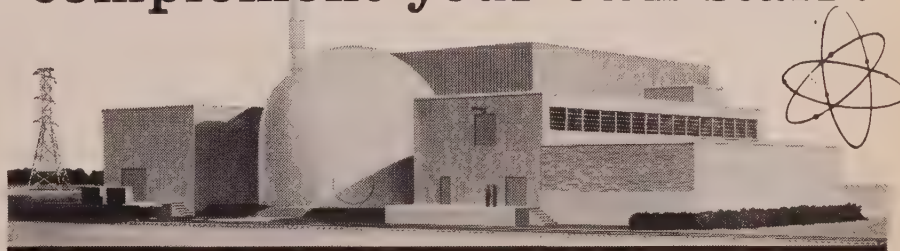
TRANSFORMER ENGINEERS WANTED—Sales or Service, Mechanical Design, Electrical Design, Production or Industrial. Excellent prospects for top men with rapidly expanding company. Write or call PRECISION TRANSFORMER CORPORATION, 2218 West Lake Street, Chicago 12, Illinois. Telephone SEeley 8-2906.

ENGINEER—ME OR EE

New Product Design. Established manufacturer of electrical connectors and distribution line hardware for the power utility trade. Experience either in the design, manufacturer or application of related products desirable. Modern plant located in suburb of large midwest city. Salary open. Write Box 4101, ELECTRIC LIGHT & POWER, 6 No. Michigan Ave., Chicago 2, Illinois.



Which Pioneer service do you need to complement your own staff?



DESIGN AND CONSULTING ENGINEERING SERVICES

Pioneer specializes in designing power plants and offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and construction management. Pioneer's other services include substation, transmission and distribution studies and design.

SERVICES IN REGULATORY MATTERS

Pioneer offers its services in all phases of Federal, State and local utility regulation, including natural gas and electric rate matters, certificate proceedings, licensed project accounting requirements, depreciation studies for rate case and income tax purposes, cost allocations and special studies.

CORPORATE SERVICES

Pioneer offers its services as business and management consultants; stock transfer and dividend disbursing agents; financial, accounting and tax consultants.

Write for Booklet "PIONEERING NEW HORIZONS IN POWER"

*Serving Electric Utilities and
Industrial Power Users Since 1902*

Pioneer Service & Engineering Co.

231 SOUTH LA SALLE STREET • CHICAGO 4, ILLINOIS

NEW PRODUCT

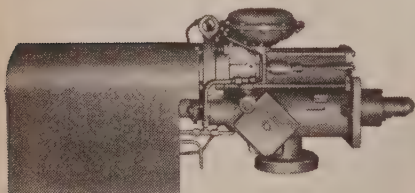
DESIGN



Wall Deslagger

By **Blaw-Knox Co.**, an air powered wall deslagger completes a normal cleaning cycle in less than 73 seconds. Two separate air drives—one to extend and retract the nozzle and the other to rotate it—make possible the high speed operation. Blowing medium may be air, saturated or superheated steam or a combination. Has external stuffing box.

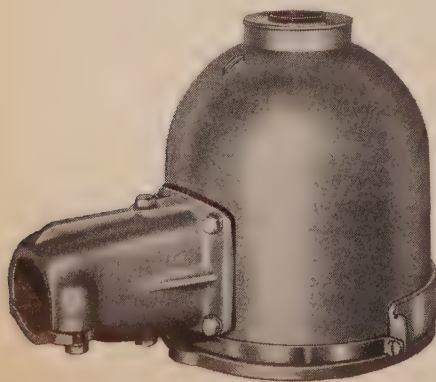
Circle item #22 on reply card



Luminaire Head

A luminaire head with adjustable latch lugs is now available from **Joslyn Mfg. and Supply Co.** The adjustable latch lugs are in the form of a band which clamps on the lower portion of the head and permits 60-degree rotation of the optical assembly in either direction. This rotation allows for proper orientation of the light pattern on the street, regardless of the position of the pipe bracket with respect to street axis.

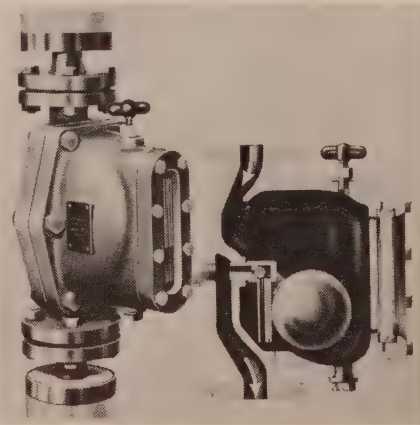
Circle item #23 on reply card



Hot Jumper Hold Stick

Designed for hot line splicing, making up, deadends, and for use in the cutting of a conductor preparatory to installing a sleeve splice, the **Bodendieck Hot Jumper Hold Stick** has a fiberglass insulating handle. Insulating interior stick controls jaw closing. In operation, strands are gripped by oval V-jaws and the sides are flush, making a guide for hot hack saw cut. Stick may be held at any position for guiding pigtail through dead end.

Circle item #24 on reply card



Steam Trap

The **Rifox** steam trap has only one mechanical moving part, thereby eliminating the cause of much of the maintenance inherent in conventional steam traps. Simple trunnion rotating valve controls the flow of condensate. Provides not only efficient quiet operation but also eliminates sudden surges of condensate. Available in sizes from .5-in. to 2-in. diameter for pressures of 35, 100, 150, 200, 400, 600, and 1000 psi.

Circle item #25 on reply card

Trencher

The **Cleveland JS-30**—with instant lateral positioning and tilting of its digging wheel—digs trench behind either crawler or at any point within its 6-ft width. It also cuts vertical trench on side slope and similar conditions where one track of the crawler is on a higher level than the other. Total tilting range is 14 degrees. Standard trench capacity is from 11 to 24 in. wide, down to 5½ ft deep.

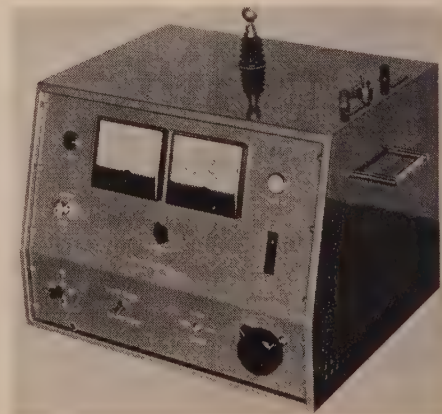
Circle item #26 on reply card

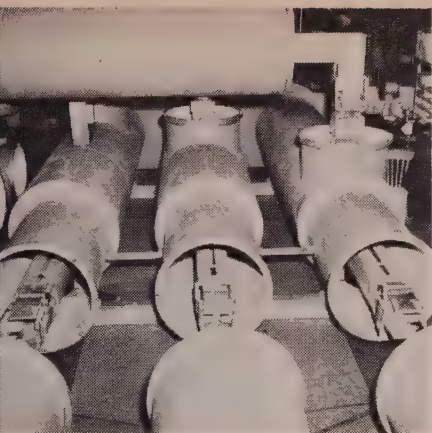


High Potential Test Set

Bench type, semi-portable high potential test sets by **Associated Research, Inc.** have outputs to 30 kv for determining dielectric strength in motors, generators, cables, and switchgear. Available with a-c or d-c output. All models provide continuously variable voltage control. Optionals include automatic rate of rise control, preset automatic cycling, and automatic cut off at prescribed limit.

Circle item #27 on reply card

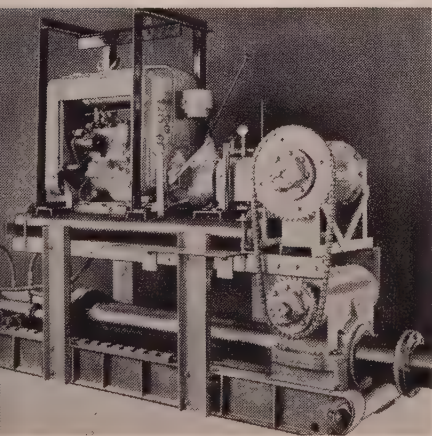




Isolated Phase Bus

A radical design concept of isolated phase bus which has reduced the occurrence of circulating currents has been announced by **General Electric**. Designed so longitudinal currents will circulate in the enclosure at all times, minimizing problems with induced currents which can occur in structural members which lay parallel to the plane of three-phase bus. Also reduces voltage build-ups between enclosures and ground.

Circle item #28 on reply card



Under-Road Borer

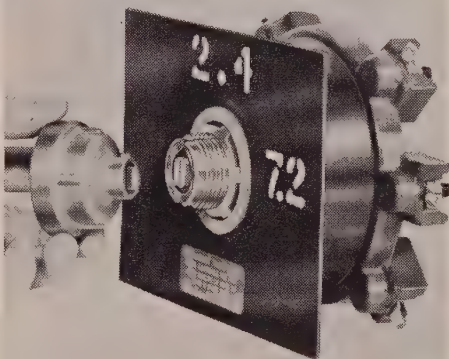
Faster, easier, and more economical installation of pipe under streets, highways and railroads is claimed by the **Young Engine Corp.** through use of its new under-road boring machine. Unobstructed vision and control from all sides are features. Unit has 35 hp power unit with four speed transmission. Bores and installs casings from 6-in. to 30-in. diameter in one operation. Cribbing, heaving and back filling are eliminated.

Circle item #29 on reply card

Dual Voltage Switch

R T & E Corp. has redesigned the external switch on its dual voltage transformer so that the switch now provides a common operating shaft for all dual voltage arrangements, including non-multiples such as 2400 x 7620. Contact structures with two blades per contact, are interlocked within the switch body for permanent alignment. Utilizes special "one way in—one way out" keying arrangement with rotor shaft.

Circle item #30 on reply card



Unbreakable Refractor

A luminaire with a virtually unbreakable plastic refractor is available from **General Electric**. The Acrylic-Suburban unit is constructed with built in ballast for up to 250-watt mercury vapor lamps or without ballast for up to 6000-lumen filament lamps. Unaffected by corrosive atmosphere, the refractor resists thermal shock and is interchangeable with glass refractors of similar design.

Circle item #31 on reply card



Snapit-On

**Protector
Shields
for
CONDENSER
AND
BOILER
TUBES**

**DETERS
EROSION**

**PREVENTS
MATERIAL
WASTAGE**

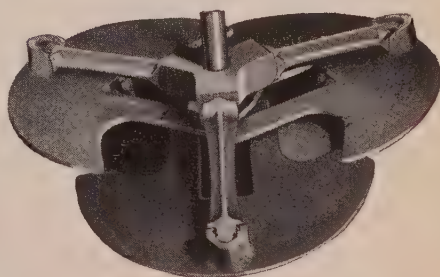
**REDUCES
MAINTENANCE**

**GIVES TUBES
LONGER LIFE**

**MADE IN STAINLESS STEEL
AVAILABLE IN ALL SIZES**

THE VINCE BASNIK COMPANY
2020 CENTER STREET • CLEVELAND 11, OHIO

**EXTRA Holding Power
QUICKLY Installed
TOUGH For long life**



EVERSTICK ANCHORS

For new construction and maintenance —Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resilient, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

TODAY'S BEST BUY

Copperweld[®]

COPPER MOLTEN-WELDED TO STEEL

TYPE



T M

Install Copperweld Type M Guy Strand on your lines. It's a low-cost, money-saving way to rid yourself, once and for all, of the trouble and expense that result when guys weaken or fail because they haven't got what it takes to resist corrosion.

Copperweld Type M Strand resists corrosion. Each wire is permanently protected against rust by a thick copper sheath that is inseparably molten-welded to a high-strength alloy steel core. And because it's molten-welded, the copper will not crack, flake or peel from the steel core.

As a result you pay for only one guy installation. You can put up Type M Guy Strand and forget it because its original strength is permanently maintained. In fact, this non-rusting guy strand will match the long life of modern poles.

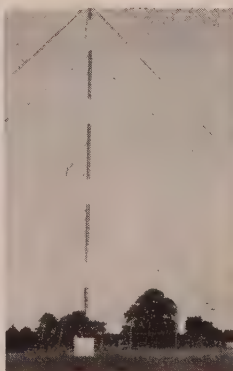
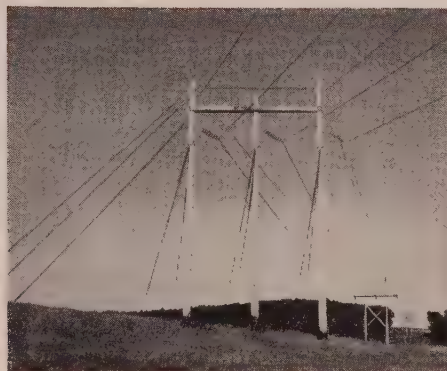
Moreover, Type M Strand goes up fast because it is easy to handle. It can be readily dead-ended by any of the conventional methods. Our Engineering Data Bulletin E.D. 1878 gives you the complete story. Send for it today.

PROVED DEPENDABILITY AND LONG LIFE.

FOR ALL GUYING PURPOSES . . .

GUY STRAND

requires no maintenance . . . matches pole life



WHATEVER YOU GUY . . . GUY WITH COPPERWELD TYPE M STRAND

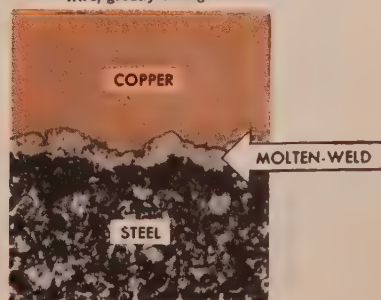
Easily installed, Copperweld Type M Strand provides low-cost, safe and permanent guying for overhead lines, towers, poles, antennas, stacks, and similar structures. Put this non-rusting strand up and prove it for yourself.

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

. . . . assured by the **MOLTEN-WELD**
-exclusive with Copperweld

Weld area of Copperweld Wire, greatly enlarged



*Trademark



"Superforms* are packaged for storeroom convenience"
... **SUPERVISOR OF STORES**

"The Fanner people understand our store-room problems.

"Their Superformed products are packaged right ... well identified ... easy to handle and store ... don't get mixed up ... are well catalogued ... and, they arrive on time."

The thousands of items that must be stocked, and readily available, present a tough problem for Store Room Supervisors. Fanner recognizes this, and cooperates!

A-1592A

FANNER

Superformed
with a

"PROTECTIVE TWIST"

ARMOR RODS ...

Protect long-span T&D lines at supports

LINEGUARDS ...

Protect short-span T&D lines at supports

PATCH RODS ...

Repair damaged conductors

TAP ARMOR ...

Protects conductor at tapping points

FANNGRIPS ...

For dead-ending strands and conductors

FANNSPLICES ...

Join two ends of conductor wire

PLASTIC PRODUCTS ...

For conductor surface protection

FANNER

The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

MEN OF



POWER

Niagara Mohawk Elects V.P.

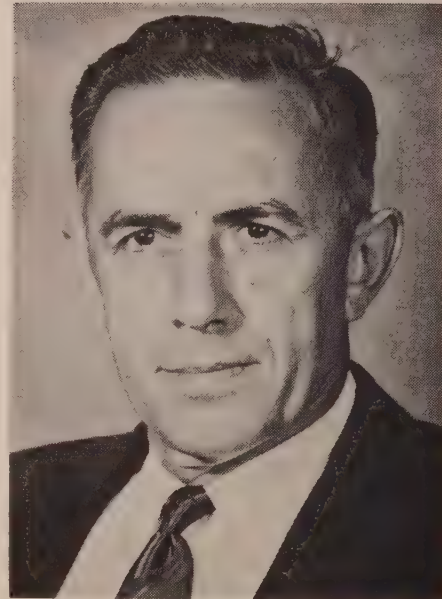
The election of F. J. Schneider to the post of vice president in charge of operations for Niagara Mohawk Power Corp. has been announced by Earle J. Machold, president.

He was formerly superintendent of operations for the western division of the company.

In his new position, Mr. Schneider will direct all electric and gas operations of the system and will headquarter in Syracuse. He succeeds Leo Welch who died in February.

Mr. Schneider has been with Niagara Mohawk since 1933, where he was a foreman in the construction department. He later served in the engineering department and was promoted to electric superintendent of the central division in 1952.

He became assistant operations superintendent of the central divi-



sion in 1954 and general superintendent of operations two years later. In 1958 he was named general superintendent of operations for the western division.

I-T-E Names Two

Harry L. Buck, formerly vice president and general manager, has been elected executive vice president, and A. E. Mackenzie, previously vice president and general manager of I-T-E's Kelman Power



Buck



Mackenzie

Circuit Breaker division, has been named to the newly created position of vice president—power equipment for the I-T-E Circuit Breaker Co.

The new appointments were made to enable the company to

manage more effectively its 14 division and subsidiary operations.

Mr. Buck has been with I-T-E for 25 years, serving as treasurer for nine years before being named vice president and general manager in 1955. He is a director of the firm and two of its Canadian subsidiaries.

Mr. Mackenzie, who will be in charge of overall operations of I-T-E divisions which produce power equipment for utility, industrial, and commercial applications. He has been with the company since 1944.

Hinkley Heads Research-Cottrell

J. William Hinkley has been elected president of Research-Cottrell, Inc., following the resignation due to illness of James M. Knox.

Mr. Knox has been elected vice-chairman of the board of the organization.

(Continued on next page)

(Continued from previous page)

Mr. Hinkley is also president of Research Corp., a foundation to provide means for scientific investigation. Research-Cottrell is a wholly owned subsidiary of the foundation.

MEN OF POWER BRIEFS

Charles W. Engelhard, president of Engelhard Industries, Inc., the world's largest refiner and fabricator of precious metals, has been elected to the board of directors of Public Service Electric and Gas Co.

Vice president **J. Reed Hartman**, Cincinnati Gas & Electric Co., has assumed wider authority in the company. He is now responsible for community relations, electric sales, customer service, advertising and media services and sales promotion.

R. M. Bibbs has been appointed administration manager of British Columbia Electric's electrical division.

Announcement has been made that **Thomas J. Galligan**, vice president and assistant to the president, has been elected to the board of the Boston Edison Co.

(Continued on page 84)

JOHN E. COOPER (r) advertising manager, Delaware Power & Light Co. receives the Silver Advertising Award from C. C. Gerow, president of the Advertising Club of Wilmington. The award, co-sponsored by the Wilmington club and the Advertising Federation of America, is presented to the outstanding advertising executive in the state on the basis of nomination from agencies, advertisers, print and broadcast media throughout the state. He has previously won numerous other honors from PUA, Freedoms Foundation, and Financial World.



A DELTA GROUNDED TRANSFORMER

will usually **SAVE SPACE AND MONEY**
when a grounding transformer is required.

Technical information and list of manufacturers licensed under U. S. Patent No. 2,488,628 and Canadian Patent No. 479,050 will be sent on request.

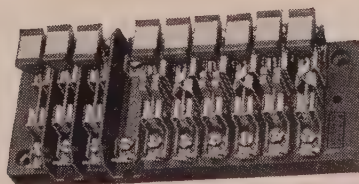
H. L. HOEPPNER

Park Ridge, Ill.
211 Imperial St.

Look to Superior for TEST SWITCHES AND BLOCKS



Test Block



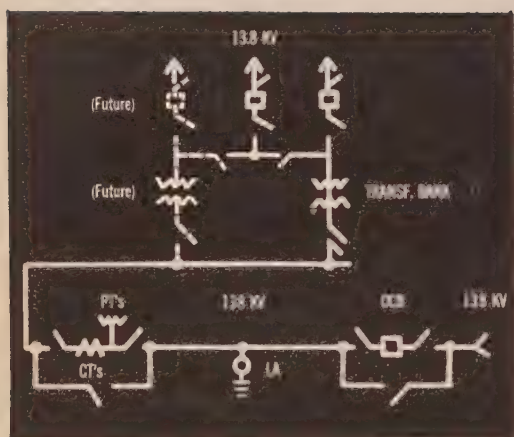
Test Switch

Superior
also offers a
complete line of
Enclosures
Socket Equipment

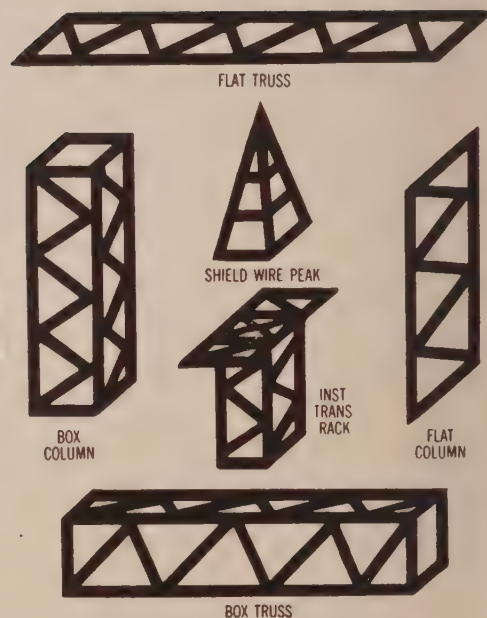
SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO

A subsidiary of
The Union Metal Manufacturing Company

Catalog 55 offers complete information on
features, services, type and sizes. Write to:

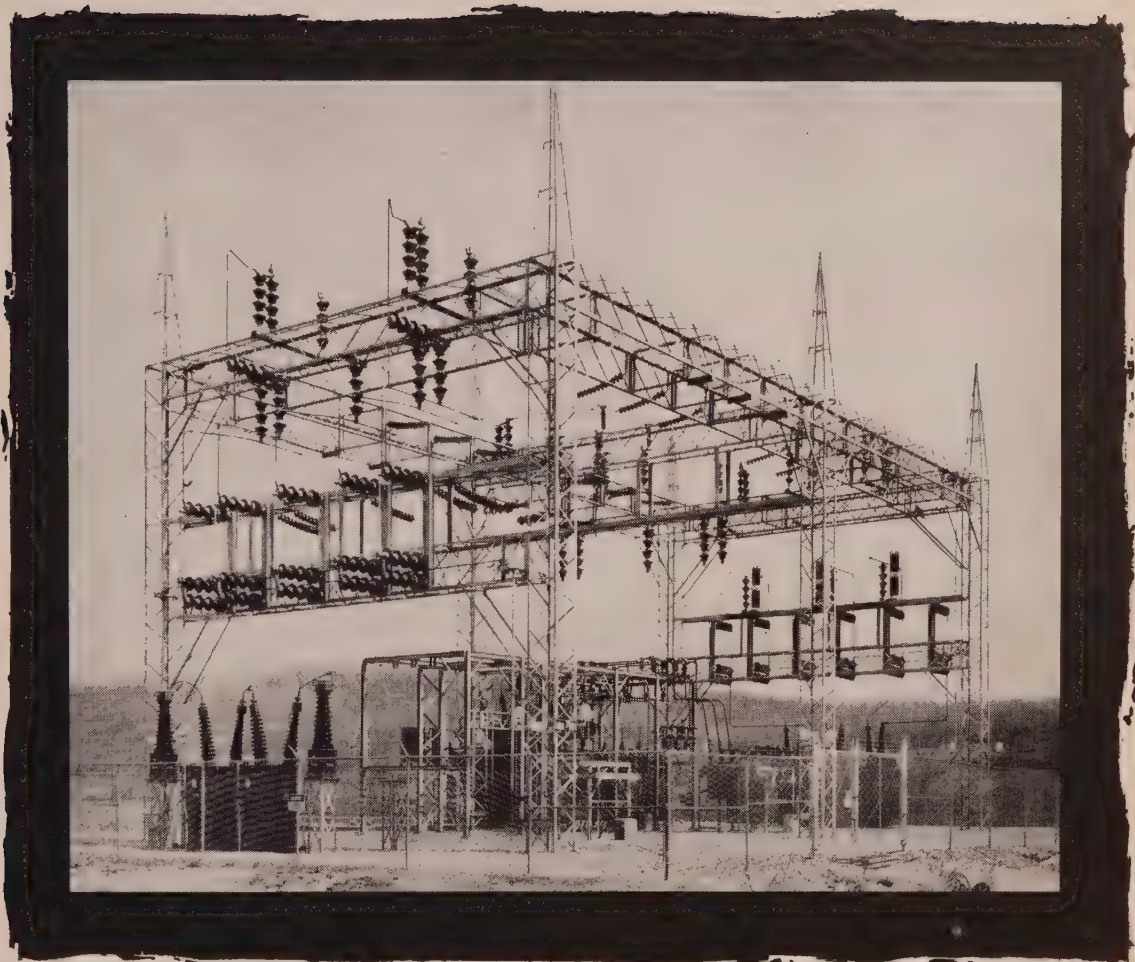


STATION DIAGRAM



NOW... LET WESTINGHOUSE STANDARD STRUCTURAL COMPONENTS REDUCE YOUR OUTDOOR SUBSTATION COSTS

- A few standardized components permit an unlimited variety of lower cost station arrangements.
- Save your design time . . . just send us the station diagram and Westinghouse will design your substation with standard components.



ADDITIONAL ADVANTAGES:

- **Outstanding Product Integration** . . . structure designers coordinate with equipment designers for single-manufacturer responsibility and single-order coordinated delivery.
- **Efficient Use of Steel** . . . maximum strength with minimum weight through proper choice of pre-designed components.
- **Simplified Field Assembly and Erection** . . . all components use interchangeable members—a few bundles of steel instead of many.
- **Uniform Structural Components** . . . give clean, uncluttered appearance to the complete station. Compact design requires minimum plot area.

Investigate this complete Turnkey Plan. Westinghouse assumes full responsibility for the satisfactory operation of the complete substation. Ask your Westinghouse sales engineer for all the facts, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60992-R

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS"
CBS TV ALTERNATE FRIDAYS

Grip-Lite

Steel Expanding ANCHORS

✓ FOUR WAY ✓ ASPHALT COATED



Exclusive wing dimples, four way design, nut retainers and double-strength anchor top. Grip-Tite grips the earth!

Come To Us With Your Anchoring Problems

- LOW INITIAL COST
- EASY TO INSTALL
- LOW INSTALLATION COST
- RUGGED STEEL CONSTRUCTION
- plus FASTEST DELIVERY IN THE INDUSTRY

DEPENDABILITY AT LOW COST

STEEL EXPANDING Grip-Lite ANCHORS

Grip-Lite MANUFACTURING CO.
BOX 111 WINTERSET, IOWA

(Continued from page 81)

William Reid Thompson, former superior court judge in North Carolina, has been an associate general counsel, Carolina Power & Light Co.

Hotpoint has named **I. L. Griffin** general manager-refrigeration department.

John R. Heim has been appointed personnel coordinator for Monongahela Power Co.

George T. Sanders is the new manager of customer marketing services. **John W. Geohegan** has become manager-merchandise sales.

American Electric Power Service Corporation's new advertising supervisor is **Alfred J. Hart**.

Everlasting Valve Co. has elected **William Harrower** chairman of the board and **George Zimmerman** vice president in charge of sales.

Carl A. Reeb, western manager of the Kerite Co., has been appointed assistant to the president. **Marshall C. Blevins**, assistant western manager, has been named to succeed Mr. Reeb.

G & W Electric Specialty Co. has announced two management appointments: **Norman O. Kirby** has been made general manager and **Robert G. Poetsch** has become sales manager.

C. A. Liming is the new corporate engineering manager-pole type equipment, Federal Pacific Electric Co.

Allis-Chalmers has formed a Power Systems Engineering department under the management of **T. G. A. Sillers**. **C. W. Bloedorn** has also been named to the new department.

Also at Allis-Chalmers, **D. B. Scott** has been appointed manager of the control department, succeeding **F. C. Ludington**, who has retired.

John V. Page has been chosen to fill the post of comptroller of the Graver Tank & Mfg. Co. recently vacated by the resignation of **William Hopewell**.

Recent appointments at G-E include: **George S. Trotter**, manager, western sales region, large lamp department; **M. C. Neuhoft**, manager of marketing administration and research, meter department; and **Dr. J. M. Witzel**, manager of engineering, insulating materials department.

Two new product managers have been appointed by National Electric division, H. K. Porter Co., Inc.: **Ray Schuler** has been named product manager, underfloor raceways, and **Irvin C. Turner** has been made product manager, surface raceways.

Nye S. Spencer, formerly sales manager of the switchboard section of the switchgear division, has been appointed manager, utility marketing, of I-T-E. He succeeds **Robert D. Cleaves**, who has resigned. At the same time, **William A. Donaldson, Jr.** has been chosen to replace Mr. Spencer.

Copperweld Steel Co. has announced the promotion of **Gordon Cavanagh** to the position of product manager for Alumoweld, the company's new aluminum-covered steel wire and strand.

Ebasco has appointed **Frank P. Wardwell**, **Warren C. Juchatz**, and **Cristopher J. Pratt** to their general management consulting staff.

Hawaiian Electric Co. has named **Francis H. Williams** promotional manager.

ALWAYS "UNDER CONTROL"

OVER 20 YEARS OF EXPERIENCE IS THE REASON!



MODEL 5940-1 TUBELESS

CONFORMS EEI-NEMA STANDARDS

Send for Free Literature!

SunSwitch DIVISION

RIPLEY COMPANY, INC., MIDDLETOWN, CONN.

Your Choice for Convenience in PITTSBURGH



Hotel Pittsburgher
Right in the heart of the Golden Triangle 400 outside rooms with TV and every comfort of modern hotel design. General Forbes Lounge and Dining Room... Air Conditioning. Airport Limousine and Taxi Service.
Forbes Avenue Below Grant
Atlantic 1-6970



Jacktown Motor Hotel
The very finest accommodations. 60 air-conditioned rooms with TV, telephone, combination tile baths. Excellent dining room. Facilities for group parties 15 to 500.
Route 30 Irwin, Pa.
1 mile West of Irwin Interchange
Underhill 3-2100



Hotel Pittsburgher Motel
Opposite Greater Pittsburgh Airport on beautiful Airport Parkway West. 56 luxurious air-conditioned rooms with tile bath, TV, private phone. Courtesy car to and from airport.
AMherst 4-5152
Joseph F. Duddy, Gen. Mgr.

***Teletype Service. For immediate confirmation of reservations at no charge... telephone any Knott Hotel-or teletype PG-29.**

COMPUTER STUDIES BY
GENERAL ELECTRIC PROVE . . .

Reduced Regulator Bandwidths Increase System Earnings

General Electric voltage regulators provide three added benefits to distribution systems through bandwidth reduction . . . extra feeder length, capacity, and revenue! New General Electric computer studies now prove that *reduced regulator bandwidths are practical* and that they result in increased distribution system performance with *no sacrifice of regulator life*.

Electric utilities have long recognized the desirability of bandwidths as low as $\pm 3/4$ volts. The assumed stumbling block was the number of regulator operations. Through analysis of actual (as opposed to theoretical) data, new General Electric computer studies indicate that bandwidths of $\pm 3/4$ volts are feasible from any standpoint, including that of equipment life.

Your General Electric regulator representative can show you the specific effects on regulator operation as bandwidths are reduced. He will show you how to determine if operations must be controlled . . . and if so, how to control them. Increase the return on your regulator investment, possibly with your existing equipment.

Take full advantage of the important benefits of General Electric ML-32 step regulators. Reduced bandwidths provide more *usable* kva on the line . . . permit increased loading of existing feeders. This easily attainable "power adder" can mean increased line length and capacity—important tools to reduce or defer investment. Reduced bandwidth settings make significant contributions to feeder revenue, too!

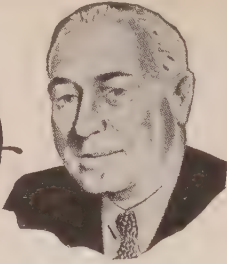
And contact your General Electric sales engineer for even more reasons why General Electric regulators cost less on the line! General Electric Company, Schenectady 5, N. Y.

456-02

Progress Is Our Most Important Product

GENERAL  ELECTRIC

*Trademark



**"Superforms* make my Budget Dollars go farther"
... PURCHASING AGENT**

"We have to look at budgets as investments... in terms of *return*... all the way from negotiating and pricing, to having equipment available when needed for use.

"With Fanner Superforms, we get *prompt quotations* from the Agent and the Factory... they *meet their commitments*... give *reliable service*."

These are reasons why more and more Purchasing Agents are buying more and more Superforms. A-1595A

FANNER

Superformed
with a

"PROTECTIVE TWIST"

ARMOR RODS...

Protect long-span T&D lines at supports

LINEGUARDS...

Protect short-span T&D lines at supports

PATCH RODS...

Repair damaged conductors

TAP ARMOR...

Protects conductor at tapping points

FANNGRIPS...

For dead-ending strands and conductors

FANNSPLICES...

Join two ends of conductor wire

PLASTIC PRODUCTS...

For conductor surface protection

FANNER

The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

SUPPLY



FACILITIES

A-C Uses Flow-On Treatment

Continuous push-button controlled lines for surface treating and painting of pole-type distribution transformers is now in operation at Allis-Chalmers Pittsburgh Works.

Transformer tanks, attached to an overhead conveyor system, are first cleaned, given an all-over phosphate coating, then flow coated and moved through a baking tunnel after each applied coat. An important innovation to the system is the drip tunnel

between the flow-on and the baking area. This drip tunnel has an atmosphere of solvent vapor which retards the drying process, permitting the paint to level out and eliminate surface irregularities due to solvent evaporation.

Field tests over an extended period in coastal and contaminated areas have proven the durability, color and gloss retention of surfaces coated by the system.



View of transformers moving down assembly line to be flow coated at Allis-Chalmers Pittsburgh plant.

Simplex To Expand Facilities

A \$3-million expansion to Simplex Wire and Cable Company's Cambridge plant will add 100,000 sq ft of manufacturing space to the company's existing plant.

The new building program corresponds with the firm's 75th anniversary. According to Everett Morss, president, large purchases of new equipment to modernize the manufacturing process will accompany the new building program.

The new building will be adjacent to the new H.V. test lab now nearing completion.

Ebasco Acquires Chicago Firm

In an expansion of its midwestern facilities, Ebasco Services, Inc., has acquired the management consult-

ing firm of H. Ferris White & Associates of Chicago.

Under the terms of the consolidation, H. Ferris White, Jr., founder and president of the company becomes resident director of management consulting services for Ebasco's central region office. James B. Hughes, a former vice president of the White organization, will become a member of the resident staff as management consultant.

Chance Vought Purchases Panellit, Inc.

Panellit, Inc. has been purchased by its former subsidiary, Information Systems, Inc., which has in turn been purchased by Chance Vought Aircraft, Inc. The name

(Continued on next page)



Crapo

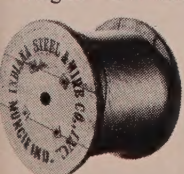
**GALVANIZED
STEEL STRAND
HAS ALL
5**

1. Strength
2. Workability
3. Ruggedness
4. Long Life
5. Economy

When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

For more than 50 years *Crapo* Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

Crapo Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.



For details, ask our distributor or write direct!

INDIANA
STEEL & WIRE
COMPANY, INC.
Muncie, Indiana

(Continued from previous page)

Information Systems, Inc. will be retained for the new company.

Panellit and The Genesys Corp., a wholly owned Chance Vought subsidiary, will become separate operating units of the new electronics firm. Albert Sperry, former president of Panellit and Information Systems, Inc., will become chairman of the board of the new firm.

ISI headquarters will be moved to Los Angeles, site of the Genesys Corp. The Panellit division will continue to operate in Skokie, Ill., a suburb of Chicago.

PRODUCTION BRIEFS

Powerdyne Inc., manufacturer of pole top switches for utility system use, has opened its doors in a new 4,000 sq ft plant in Oswego, Oregon.

A 30,000 sq ft expansion and new building is under construction by **Computer Systems, Inc.**, manufacturer of analog computers, simulators, and accessories. The new facility is due for completion in May of this year.

Keystone Mfg. Co. has completed the expansion of its Special Products division to offer complete design, engineering and fabrication services for all types of custom wiring enclosures.

RCA will soon open a new facility at Natick, Mass., to turn out electronic computer systems that think for themselves. Output of the plant will be control computers.

Bendix Aviation Corp. has purchased an 80 acre site in the San Fernando Valley, Calif. A 650,000 sq ft facility for the development of both industrial and military electronic systems. Bendix has also announced that it will build a new plant for the manufacture of its medium size G-15 digital computer and transistorized computing equipment adjacent to the computer division's headquarters in Los Angeles. The corporate name will be changed to The Bendix Corporation on or about June 1.

**"DRILLED MORE
THAN 100 HOLES
in Hard Concrete
WITHOUT
RESHARPENING"(*)**

IMPOSSIBLE with steel
star drills! **ROUTINE** with the
NEW ENGLAND

Thunder-twist®

Carbide-Tipped
**MASONRY
BITS**

Most economical bit you can use in any electric or pneumatic hammer! Drills in any masonry from brick to granite. Does the work of 16 star drills. And it's a one-man operation! Exclusive combination of vertical and spiral flutes provides positive dust removal... no packing, stalling, or binding. Tops in economy and efficiency on every job. Sizes: 3/16" to 1 1/2" diameter. Extended lengths up to 18". Send for free drilling manual.

Other New England Carbide-Tipped Bits Include:

Cyclo-twist®

Bits for rotary drilling of ordinary masonry.

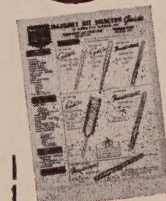
Cyclo-Core®

Multi-Tipped Bits for rotary drilling of hard masonry.



**Designed, Engineered,
and Proven for the Job.**

(*) Write for proof of performance



Send for Free "MASONRY
BIT SELECTOR GUIDE" and
Start Using Today's Most
Economical Masonry Bits

New England
CARBIDE TOOL CO., INC.
55E Commercial St.
Medford 55, Mass.

Please send me a copy of the FREE
"MASONRY BIT SELECTOR GUIDE"

Name.....

Address.....

City.....State.....

*Trademark



"Superforms* handle well"
...say **CONSTRUCTION and
MAINTENANCE ENGINEERS**

"Superforms require no tools for regular use . . . they are readily adaptable for hot-line tools . . . they give us uniformity of application and result . . . they *handle well!*"

Construction and Maintenance Engineers . . . the men responsible for *getting things done Fast, Right and at Low Cost* . . . are making more and more use of Fanner Superforms, everywhere!

A-1589 A

FANNER
*Superformed**
with a

"PROTECTIVE TWIST"

ARMOR RODS . . .

Protect long-span T&D lines at supports

LINEGUARDS . . .

Protect short-span T&D lines at supports

PATCH RODS . . .

Repair damaged conductors

TAP ARMOR . . .

Protects conductor at tapping points

FANNGRIPS . . .

For dead-ending strands and conductors

FANNSPLICES . . .

Join two ends of conductor wire

PLASTIC PRODUCTS . . .

For conductor surface protection

FANNER

The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

Howell Electric Motors Co. has purchased the flat-type motor line of the **Diehl Mfg. Co.** Purchase price includes tooling, machinery and design used in the manufacture of the motors.

American Chain and Cable Co. has purchased **Electro-Mech Corp.**, manufacturer of controls and control systems.

Riley Stoker has announced that they have entered into an agreement with **Societe d'Exploitation d'Usines Metallurgiques of Corbehem** for the manufacture of their line of equipment in France, Spain, Portugal and their possessions.

SALES BRIEFS

General Electric has established a Components Sales Operation with headquarters in Ft. Wayne, Ind. Manager of the new operation will be **Arthur W. Bartling**. The new unit will handle field sales and service on component products used by other manufacturers.

I-T-E has announced two new district managers: **Karl Kelly**, manager of the Pittsburgh district sales office, and **C. E. Wood**, manager of the Miami district sales office.

D. W. Onan & Sons, Inc. has appointed Onan Eastern Corp. representatives for the New York City trading area, northern counties of New Jersey, and Connecticut. The new firm is independently owned and is headed by **Ralph Siegel**, president.

Warren R. Kenefick has been named sales engineer in its south-east division for **Edward Valves, Inc.** He will cover Georgia, Alabama, Florida, the Carolinas, and most of Tennessee from the Atlanta district office.

Pfaff & Kendall has announced that **B. E. Watson and Associates**, Dallas, Tex., will service the northern Texas and Oklahoma area; for the P&K line of aluminum street lighting standards.

"The brightest time of my life is on a Haley pole!"

Haley's

CEDAR POLES
and
FIR CROSS ARMS

Light in weight and clean.
PENTACHLOROPHENOL treated in our modern plant for protection against decay, moisture and insect damage.

TWO strategically located yards:
MINNEAPOLIS, MINNESOTA
FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG.
TOLEDO 4, OHIO

PEA Planning . . .

(Continued from page 69)

is also felt on transmission and sub-transmission while still improving voltage conditions along the primary circuits themselves.

A digital-computer program for determining distribution-substation transformer changes and purchases required, when system characteristics and load-growth data are fed into the computer memory, was described in a paper by M. H. Gring and A. O. Thomas, both of Pennsylvania Power & Light Company. While it was agreed they said, that the same results could be obtained through use of engineering assistants, they felt that cost of obtaining this information was less through use of the digital computer.

A method of establishing trends of historical data which follow a diminishing-rate-of increase law was described by L. M. Webb, Hartford Electric Company. Rates of growth that could not be plotted as straight lines on semilog paper or through using Gompertz or logistic or least-squares methods appeared as straight lines when the scale of one coordinate of a graph paper was made logarithmic and the scale of the other was made an arithmetic progression, he said. The arithmetic-progression scale is made so that the difference between successive terms equals the first term minus the last term divided by one less than the number of terms. Not only do individual groups of data following a diminishing rate of growth show as straight lines on such paper, he said, but also when lines for several components which add up to a whole are extrapolated as continuations of the individual straight lines, the line representing the whole continues to equal the sum of its parts at all points. A more complete description of this method will appear in an early issue of EL&P.

Survey Shows Resistance Space Heating Predominant

A survey shows that 78 percent of the 40 electric utilities questioned are promoting electric space heating, either of the resistance or of the heat-pump type, reported A. Bertollett for the load-analysis subcommittee. Of these, 25 percent are actively promoting resistance heat-

ing and 75 percent are promoting both types of heating. Seventy-eight percent of the companies recommend minimum insulation provisions but most do not enforce this. Most of the companies either did not know or have found little change in load factor and power factor of the system. However, with saturations of below one percent for either device, not too much change could be expected.

Definitions Of Service Reliability Needed

Better means for reporting and interpreting service outages are needed, declared members of the service-continuity subcommittee. Questions like, "What is an interruption and how can it be defined?" and "Number of customers involved, and frequency of interruptions, as well as extent of areas affected" are important, they said, and must be answered before reports from different companies can be compared.

One company measures service interruptions as follows:

$$\begin{aligned}\text{Frequency} &= \frac{\text{Number of Customers Interrupted}}{\text{Number of Customers Served}} \text{ in } \% \\ \text{Duration} &= \frac{\text{No. of Customer Interruption Minutes}}{\text{Number of Customers Served}} \\ \text{Restoration Time} &= \frac{\text{No. of Customer Interruption Minutes}}{\text{Number of Customers Interrupted}}\end{aligned}$$

Another company uses a somewhat similar measure called "Reliability Index" as follows:

$$\text{Reliability Index} = \frac{\text{Total Customer Min. Interrupted}}{\text{Total Customer Minutes in Period}} \times 10^6$$

W. M. Pinkey, West Penn Power Company, reported that his company uses IBM cards for all outages one minute or longer. Analysis of these records shows, he said, that 44.5 percent of these outages are planned, weather is responsible for 20.5 percent, and the remaining 35.0 percent were attributed to other causes. Lightning has been found the reason for 63 percent of weather-caused accidents with rain and wind responsible for another 13.

SERIES CAPACITORS . . .

(Continued from page 60)

economical means of reducing voltage fluctuations and increasing circuit stability limit; incorrectly applied it may even aggravate existing conditions. The degree of correction obtainable from a series capacitor can be accurately predicted from design calculations, provided the circuit constants and load characteristics are known. The importance of determining load characteristics by actual tests cannot be overemphasized.

In a typical series capacitor installation where X_c is approximately equal to X_L , the probability of establishing a resonant condition is relatively small but unpredictable. However small the probability, it is still sufficient to warrant taking primary voltage charts on the feeder immediately after the installation is completed. Brush Recorders, magnetic oscillographs, or other instruments having similar frequency response will reliably indicate the presence or absence of a resonant voltage component. Should a resonant condition exist,

it can usually be corrected by reducing the value of the damping resistors. In unusually severe cases, such as those often associated with over-compensation, it may be necessary to reduce the capacitive reactance or to relocate the series capacitor.

To a limited extent, series capacitors will also provide certain other benefits such as increased steady voltage level and power improvement more commonly associated with shunt capacitors. Primarily, however, series capacitors are installed to reduce the net reactance of the circuit; any other benefits obtained are incidental.

Reducing impedance of overhead feeders by increasing conductor size soon reaches the point of diminishing returns because of the inductive reactance inherent in the spacing of over-head conductors. This basic limitation of overhead circuits plus the trend toward increased use of television sets and other flicker-sensitive loads in outlying areas served almost exclusively by overhead lines, indicates a continuing and possibly increasing need for series capacitors.

CALENDAR OF EVENTS

INDEX TO ADVERTISERS AND THEIR AGENCIES

April 3-8—Engineers Joint Council, Nuclear Congress, Coliseum, New York, N. Y.

April 7-8—Southeastern Electric Exchange, Engineering and Operation Section Conference, Roosevelt Hotel, New Orleans, La.

April 11-13—A. and M. College of Texas, Thirteenth Annual Conference for Protective Relay Engineers, College Station, Tex.

April 20-22—Missouri Valley Electric Association, Engineering Conference, President Hotel, Kansas City, Mo.

April 27-29—Northwest Electric Light and Power Association, Engineering Conference, Hotel Florence, Missoula, Mont.

April 28-29—Pennsylvania Electric Association, Systems Operation Committee, Bedford Springs Hotel, Bedford, Pa.

May 2-4—Edison Electric Institute, Purchasing and Stores Committee, Annual Meeting, The Warwick, Philadelphia, Pa.

May 12-13—Public Utilities Advertising Association, Annual Convention, Waldorf Astoria Hotel, New York, N. Y.

May 12-13—Pennsylvania Electric Association, Industrial Sales Conference, Skytop Club, Skytop, Pa.

May 15-17—Wisconsin Utilities Association, Accounting Conference, Lake Lawn Lodge, Delevan, Wisc.

May 16-18—Pacific Coast Electrical Association, Annual Convention, Stardust Hotel, Las Vegas, Nev.

May 23-25—Northwest Electric Light and Power Association, Business Development Conference, Chinook Hotel, Yakima, Wash.

June 2-3—Southeastern Electric Exchange, Industrial Power Sales Conference, Battery Park Hotel, Asheville, N. C.

June 6-8—Edison Electric Institute, Annual Convention, Atlantic City, N. J.

June 19-24—American Institute of Electrical Engineers, Summer General Meeting, Chalfont-Madden Hall, Atlantic City, N. J.

September 7-9—Northwest Electric Light and Power Association, Annual Convention, Glacier Park Lodge, Glacier National Park, Mont.

September 28-30—Indiana Electric Association, 51st Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.

Allis-Chalmers Mfg. Co.
Inside Front Cover, 72
Klau-Van-Pietersom-Dunlap, Inc.

Basnik Co., The Vince.....77
Malcolm Advg. Agency

Blackburn Corp., Joseph.....24, 25
Ridgway-Hirsch Advg. Co.

Burndy Corp......6
Ted Gravenson, Inc.

Chance Co., A. B......14
Arthur R. Mogge, Inc.

**Copperweld Steel Co.,
Wire & Cable Div.**.....78, 79
Reuter & Bragdon, Inc.

Ebasco Services, Inc......40
Albert Frank-Guenther Law, Inc.

Everstick Anchor Co......77
Colle, McVoy, Weston, Barnett, Inc.

Fanner Mfg. Co......80, 86, 88
Palm & Patterson, Inc.

G & W Electric Specialty Co......17
Arthur R. Mogge, Inc.

**General Electric Co.,
Schenectady**.....38, 39, 85
G. M. Basford Co.

**Goodyear Tire & Rubber Co.,
Industrial Products Div.**.....11
Kudner Agency, Inc.

Grip-Tite Mfg. Co......84
Nelson Advg. Co., Inc.

Haley & Co., R. G......88

**Hatfield Wire & Cable Div.,
Continental Copper & Steel
Industries, Inc.**.....12, 13
Lewis Advg. Agency

Hoepfner, H. L......81
John H. Wells & Associates

Holan Corp......33
Bayless-Kerr Co.

Hotel Pittsburgher.....84
Bachman, Kelly & Trautman, Inc.

Indiana Steel & Wire Co., Inc......87
Bob Robinson, Inc.

Joslyn Mfg. & Supply Co.
Outside Back Cover
Donald L. Arends Advg.

Kearney Corp., James R......26, 27
Lynch & Hart Advg. Co.

Kerite Co......41
O. S. Tyson & Co., Inc.

Lapp Insulator Co., Inc......22
Wolff Associates, Inc.

Moloney Electric Co......34, 35
Hebert-Robinson, Inc.

New England Carbide Tool Co., Inc......87
Silton Brothers, Callaway, Inc.

Ohio Brass Co......Inside Back Cover
Howard Swink Advg. Agency, Inc.

**Pennsylvania Transformer Div.,
McGraw-Edison Co.**.....15, 16
Ruben Advg. Agency

**Phelps Dodge Copper Products
Corp.**.....30, 31
Compton Advg., Inc.

Pioneer Service & Engrg. Co......75
The Biddle Co.

**Ripley Co., Inc.,
SunSwitch Div.**.....84
The Passante Co.

Sangamo Electric Co......20, 21
Arthur R. Mogge, Inc.

**Studebaker-Packard Corp.,
Fleet Sales Div.**.....18, 19
D'Arcy Advg. Co.

Superior Switchboard & Devices Co......81
Griswold-Eshleman Co.

Union Metal Mfg. Co......44
Griswold-Eshleman Co.

Uptegraff Mfg. Co., R. E......23
Downing Industrial Advg., Inc.

Wagner Electric Corp......32
Arthur R. Mogge, Inc.

**Westinghouse Electric Corp.,
Pittsburgh**.....28, 29, 42, 43, 82, 83
Fuller & Smith & Ross, Inc.

Wheeler Mfg. Co., C. H......36, 37
T. K. Thompson Associates, Inc.

Electric Light and Power, April 1, 1960